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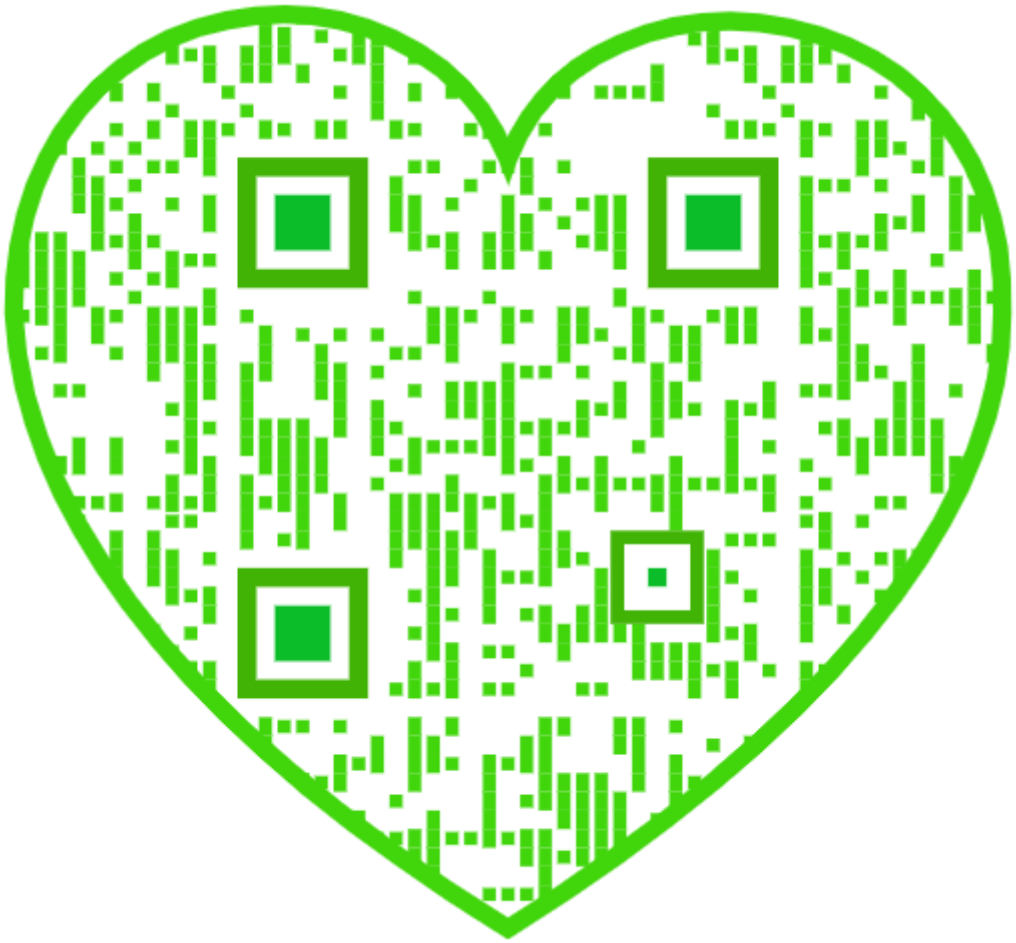


SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XXXII.—No. 1. [NEW SERIES.] NEW YORK, JANUARY 2, 1875. [$3.20 per Annum, Postage prepaid.

IMPROVED PLANING AND MATCHING MACHINE.

The invention herewith illustrated belongs to the large and varied class of planing and matching machines, of which almostevery wood-working shop of medium and even of small size has a representative tool. It presents the advantages of strength, compactness in form and design, and economy in room, power, and cost. It is adapted to plane and match hard or soft lumber up to 14 inches in width, and will surface 24 inches wide and up to 5 inches in thickness, by dropping the matcher shafts below the bed. There is a strong, heavy, and substantial frame. The bearings are perfectly fitted by scraping, and made of the best anti-friction metal, the latter compounded for the purpose by the manufacturers. The bearings also have self-oiling boxes, and the steps of the spindles are also self-lubricating.

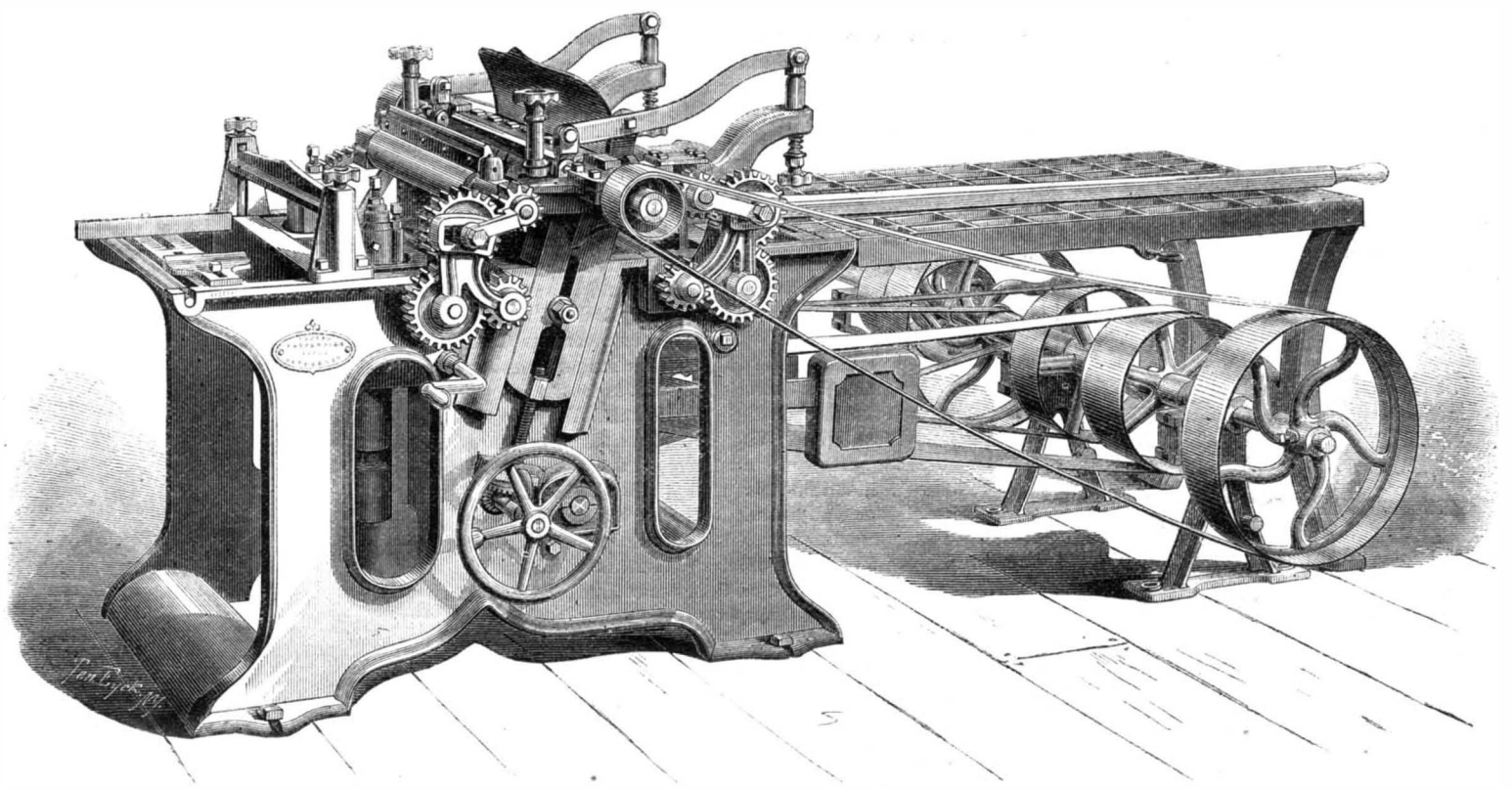
The cylinder cutter head is made triangular, of a peculiar form, and carries three knives. The last though straight, similar to thos egenerally used, make a drawing cut, thereby nsuring a very smooth surface even if the material be cross-grained or knotty. The cylinder has long steel journals, and on each end a driving pulley, and can be raised or lowered while in operation. Both cylinder and top rolls are raised and lowered together by one hand wheel, in planed ways at an angile,in order to keep the belt at the proper tension for any desired thickness of lumber.

The machine is furnished with a newly patented sectional chip breaker, and an adjustable pressure bar, which holds the lumber down so that, as nearly as possible, a uniform surface is presented to the revolving knives of the cutter. The one piece pressure bar, held by springs or weights, presses the material only along the whole line of cut or width, and rests upon salient points or elevations, without allowing for the warp or sinuosities of the timber. If it is required to press the material which is in wind in its whole width to the table, the driven roller in front of the chip breaker is brought down, but the chip breaker itself only sufficient to bring its parts in a perfect contact with the whole width of the material. Heretofore the pressure bar had to press very heavily on the work, which made it necessary to use much feeding power to overcome the resistance. The feed rolls are weighted and strongly geared.

The arrangement for changing from a matcher to a surfacer is very complete, and the adjustment can be made with facility. For surfacing wide lumber, the matcher spindle can be lowered out of the way by loosening the adjustable step and letting the top of the spindle slide below the table. One of the matcher spindles is adjustable by a crank wrench, while the other may be placed to suit the width and nature of the work.

A matcher clip is furnished for preventing splitting and tearing cross-grained lumber when matching, also a lever to hold the lumber to the guide when feeding the lumber in. The matcher heads are made of gun metal and provided with a full set of cutters. The feed of the machine can, on either side, be instantly started or stopped.

The invention is covered by several patents secured through the Scientific American Patent Agency. For further particulars, address the manufacturers, Bentel, Margedant & Co., Hamilton, Ohio.



BENTEL, MARGEDANT & CO.'S PLANING AND MATCHING MACHINE.

Action of Magnets on Spectra.

M. Choquart, of the French Academy of Sciences, states that the effect of magnetic influence on the spectra of the flames of sulphur and selenium is to cause them to pale and finally to become quite extinguished. On the other hand, the same influence multiplies the rays and renders more brilliant the spectra of chlorine and bromine. The effect, says the investigator, is so rapid as to seem magical. The result of these discoveries is to render the deductions from the spectra of the heavenly bodies only to be accepted with great caution, as they virtually introduce a new element to be considered in drawing conclusions from the aspect of the same.

IMPROVED SHOT POUCH SLING.

Mr. William W. Kollock, of Augusta, Ga., has patented, through the Scientific American Patent Agency (November 17, 1874), a novel and simple shot pouch sling, by means of which the pouch may be conveniently carried in such a manner that it cannot become detached and lost, and so that it will always be in handy position for loading the gun.

The annexed engraving shows its arrangement. The strap which passes over the shoulders is made in two parts, buckled together so as to admit of adjusting. To the end is attached a ring strap of a size to fit around the smaller part of the pouch; and above, a larger ring strap is attached to encircle the corresponding portion of the flask. There are two straps more, one of which is secured to both ring straps at one side, terminating in a buckle at the upper strap; and the other is similarly attached, but passes up over the top of the pouch. The end is then fastened by the buckle just mentioned. The pouch thus held is prevented from being lost by the tearing off of the rings. The invention seems a useful one, and doubtless will meet with appreciation among sportsmen generally. For further particulars address Mr. E. M. Habershaw, or the inventor, as above.

The Stevens Battery.

A contemporary publishes the following list of offers for the Stevens battery, or for portions thereof, which was recently offered for sale on terms which we have already published:

T. F. Rowland, Brooklyn, N. Y. For the 15 lots, $80,000.

The Chief of Bureau of Construction and Repairs of United States Navy Department. For all the lots, $145,000. This bid was accompanied with a proviso that, if any foreign government offered more, with the intention of removing the ship from the United States, then the United States Navy Department would increase their bid so as to exceed any such offer, subject, however, to the approval of Congress, which would have to make an appropriation for that purpose.

John Roach, New York. For total lots, $105,000.

John Stewart, New York. For lots 14 and 15, $3,000.

H. McKay, No. 52 Broadway, New York. For total lots, $50,000,

J. H. Wiggins, New York. For total lots, $60,000.

John F. Feffenly, No. 533 Water street, New York. For lots 14 and 15, $4,500.

N. Lassar & Sons, Hoboken. For lots 14 and 15, $5,274, and for lot 1, which consists of the hull, $20 per tun for the scrap iron, and $2,600 for another lot.

A. Pervis & Son, Philadelphia. For lots 1 to 14, $52,000, and for lots 14 and 15, $52,000.

We have often read of the value of workmanship, and how raw material worth a few cents a pound may be, by skillful manipulation, changed into watch hair springs worth their weight in gold or microscope objectives more precious than diamonds; but here we see that, in the estimation of would-be purchasers, the value of a vessel that cost millions of dollars, expended with a vast amount of the highest engineering talent, is not over $145,000 in any case, unless some other government than our own wants it; and then the importance of the vast structure to our navy will be allowed to magnify the price indefinitely. Solomon said, ages ago: "It is nought, it is nought, saith the buyer; but when he hath gone his way, then he boasteth."

I. C. says: "A one-line advertisement in the Scientific American paid me fifty-three dollars and fifty cents."

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NEW YORK, SATURDAY, JANUARY 2, 1875.

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THE VACUUM AN ABSOLUTE NON-CONDUCTOR OF ELECTRICITY.

The passage of electricity through rarefied air constitutes a well known experiment in the lecture room of physical science. The oldest style of performing it is to attach, by means of a stopcock connection, a long glass tube to the air pump, each end of the tube being provided with brass caps. The electricity may be made to flow through its interior as soon as the exhaustion of the air has proceeded to a certain extent; then a most beautiful exhibition is produced in the dark, resembling the aurora borealis; hence such a tube is called an aurora tube, and the aurora borealis has been ascribed to a discharge of electricity from the polar regions to the equator, through the stratum of rarefied air above the clouds. Another form of this experiment is the so-called electric egg, which differs from the preceding in nothing but that, in place of a long tube, an egg-shaped glass globe is employed, into which brass knobs or points project from both ends.

Lately this same experiment has been modified, so that the vessel filled with rarefied air is always ready for the experiment. Gassiot and Geissler first conceived the idea of manufacturing small and large glass tubes, melting pieces of platinum wire into their extremities, so as to introduce the electric current, exhausting the air in them to the proper degree, and then sealing them hermetically.

As it had been found that rarefied gases of different natures produce different colors of light in the dark when the electric current was passed through them, and later that different kinds of glass and liquids, when illuminated in this way, produced a great variety of effects (due to fluorescence), a very extensive assortment of these tubes was soon in the market; and they may now be bought, under the name of Geissler tubes, from the dealers of philosophical instruments in our large cities, at different prices, varying according to their size and the elaboration of their construction.

Experiments prove that electricity is retained on the surface of bodies by the presence of the atmosphere, which is an isolating substance; and that when its pressure decreases, the escape of electricity becomes easier; while, in a good vacuum, the resistance to escape becomes zero, and the electricity flows off and cannot be retained at all. This has for a long time been the accepted theory, and is still taught in most text books on physics, and is believed in by most electricians; but that it is an error was proved by Bécquérel, Hawksbee, Gray, and Snow Harris, as they showed that even the weakest electric discharges could be retained in vacuo. Bécquérel even went so far as to show that the charge was retained for fifteen days, provided that the vacuum was so perfect as to be equal to a mercurial pressure of one millimeter (the twenty-fifth part of an inch); and he concluded that, in a perfect vacuum, the body would retain the charge for ever: in other words, that electricity could not be transmitted through an absolute vacuum.

Du Moncel, in his lately published French work on the Ruhmkorff coil, gives an account of his experiments in passing a powerful electric current through a tube in which the air was being more and more rarefied, and states that, when the vacuum was made very nearly perfect by the continued operation of a good air pump, the passage of electricity through the tube continually diminished; so that at last, when the pressure had decreased to less than a half millimeter (one fiftieth of an inch), the light had almost disappeared, while tests proved that very little electricity passed; when, however, a little air was gradually admitted into the tube, the electric current was re-established, and the light appeared again.

Gassiot was the first who attempted to make an absolute vacuum, deprived of all traces of air or gas. He first made a barometer of the easily fusible alloy made of lead, tin, bismuth, and cadmium, which melts below 150° Fah., contains no mercury, and which would not contaminate the vacuum with mercurial vapors. He did not, however, succeed in this way, as the vacuum thus made always contained traces of air or gas. He tried then another method; he filled the vacuum with pure carbonic acid gas; and after exhausting by the air pump, he left the remnant to be absorbed by caustic potassa, which, by its well known great affinity for this gas, removed the last traces. He produced in this way a vacuum much more perfect than any one ever did before; while his manner of procedure allowed the experiment to be extended over several days, and even weeks. When the vacuum had been made with the air pump on carbonic acid, an electric discharge, which, in the air, would not pass over a distance of half an inch, traversed twenty inches with the greatest ease. In proportion as the vacuum became more perfect by the absorption of the carbonic acid, the discharge tended to fill the tube with a more and more pale luminous vapor. The vacuum becoming more perfect in the course of several days, the luminosity became confined to the sides, where the platinum wires, which conducted the electricity, entered into the vacuum; and a certain space, half way, became dark, and this darkness extended itself, so that, in a tube of twenty inches length, it occupied nearly ten inches. When a galvanometer was placed in the circuit, it indicated that there was no longer a constant discharge as before, but occasionally alternate discharges: when also the tube showed light flashes, and the so-called stratification of the light. When at last the absorption went on, and formed a perfect vacuum, perfect darkness was obtained in the tube, and no trace of light showed itself, even with strong electric charges, while neither the galvanometer nor an ordinary vacuum tube, when introduced into the circuit, would manifest a trace of any current, notwithstanding that this other ordinary vacuum tube showed luminosity with feeble currents. From all this, it is therefore evident that it is practically demonstrated that the absolute vacuum is not only a non-conductor, but that it is absolutely impenetrable by electric discharges.

De la Rive studied the phenomena observed. As soon as, during the attempts to pass the electric current, a small amount of gas is introduced, corresponding with a mercurial pressure of $\frac{1}{4}$ millimeter ($\frac{1}{100}$ inch), he found that the phenomena vary, according as the gas is admitted near the positive or the negative side; and he gives a very detailed description of the so-called stratification, the succession of colors, the rose-colored mist, etc., phenomena which are always repeated under the similar circumstances, depending, of course, upon certain laws governing the relation between the electric and luminous vibrations.

The writer of this article possesses a strong glass tube in which, after the method of Gassiot, the vacuum has been produced by the absorption of carbonic acid. The ends of the platinum wire intended to introduce the electric current are only one quarter inch distant from each other. But notwithstanding this short space, the strongest possible charge cannot be made to traverse this distance of vacuum, while the same charge will pass through a distance of six inches in common air, and of as many feet through a glass tube in which the air is rarefied. In the Stevens Institute, Hoboken, the experiment with a similar tube can be shown to any visitor, and excites the surprise of many who still persist in the faith in an electric fluid, notwithstanding they have abandoned the doctrine of a caloric fluid, being advanced enough in their ideas to be satisfied that heat is a mere mode of motion of ponderable matter.

Now the fact is that the whole science of thermotics cannot produce a single experiment upsetting the old doctrine of a caloric fluid, so conclusive as the experiment above described. Nobody has ever succeeded in producing an empty space or vacuum through which heat could not pass; but having done so for electricity, it proves conclusively that this subtle agent cannot be of the nature of a fluid, as a fluid would not be arrested by a vacuum. It proves that electricity must be a mode of motion (wave vibration or molecular rotation) of ponderable matter, which cannot be propagated except by such matter, and will be as effectively arrested in its propulsion, when ponderable matter is absent, in the same way as is the the case with the sound waves when the medium by which they can be transmitted is wanting.

DON'T KISS THE BABY!

The promiscuous kissing of children is a pestilent practice. We use the word advisedly, and it is mild for the occasion. Murderous would be the proper word, did the kissers know the mischief they do. Yes, madam, *murderous*; and we are speaking to you. Do you remember calling on your dear friend Mrs. Brown the other day, with a strip of flannel round your neck? And when little Flora came dancing into the room, didn't you pounce upon her demonstratively, call her a precious little pet, and kiss her? Then you serenely proceeded to describe the dreadful sore throat that kept you from prayer meeting the night before. You had no designs on the dear child's life, we know; nevertheless you killed her! Killed her as surely as if you had fed her with strychnin or arsenic. Your caresses were fatal.

Two or three days after, the little pet began to complain of a sore throat too. The symptoms grew rapidly alarming: and when the doctor came, the single word *diphtheria* sufficed to explain them all. To-day a little mound in Greenwood is the sole memento of your visit.

Of course the mother does not suspect, and would not dare to suspect, you of any instrumentality in her bereavement. She charges it to a mysterious Providence. The doctor says nothing to disturb the delusion; that would be impolitic, if not cruel: but to an outsider he is free to say that the child's death was due directly to your infernal stupidity. Those are precisely his words: more forcible than elegant, it is true; but who shall say, under the circumstances, that they are not justifiable? Remember

"Evil is wrought by want of thought
As well as by want of heart."

It would be hard to tell how much of the prevalent sickness and mortality from diphtheria is due to such want of thought. As a rule, adults have the disease in so mild a form that they mistake it for a simple cold; and as a cold is not contagious, they think nothing of exposing others to their breath or to the greater danger of labial contact. Taking into consideration the well established fact that diphtheria is usually if not always communicated by the direct transplanting of the malignant vegetation which causes the disease, the fact that there can be no more certain means of bringing the contagion to its favorite soil than the act of kissing, and the further fact that the custom of kissing children on all occasions is all but universal, it is not surprising that, when the disease is once imported into a community, it is very likely to become epidemic.

It would be absurd to charge the spread of diphtheria entirely to the practice of child-kissing. There are other modes of propagation, though it is hard to conceive of any more directly suited to the spread of the infection or more general in its operation. It stands to diphtheria about the same relation that promiscuous hand-shaking formerly did to the itch.

It were better to avoid the practice. The children will not suffer if they go unkissed; and their friends ought for their sake to forego the luxury for a season. A single kiss has been known to infect a family; and the most careful may be in condition to communicate the disease without knowing it. Beware, then, of playing Judas, and let the babies alone.

POSTAL DETECTIVE SERVICE.

It is rather more the custom to abuse the officials of the post office, for losses, irregularities, and other difficulties happening in the mails, than to give them credit for their skill in the detection of crime and recovery of missing property. We hasten, therefore, to put on record a recent instance of a prolonged search for lost money in which we have been directly interested, and which has resulted in a remarkable and praiseworthy success on the part of the post office detectives. On the first of May last, a correspondent in a village in Louisiana mailed a registered letter to this office, and enclosed therein the sum of sixteen dollars. The missive failed to reach us, and we notified both our correspondent and the post office authorities. The latter placed the case in the hands of special agents, and for the past seven months the detective officials have been actively at work tracing the lost missive. We, and doubtless the sender of the money, had given up hope of its recovery, and hence our astonishmnet was all the greater at the reception, a few days ago, of a terse communication, signed L. M. Terrell, Superintendent Railway Mail Service, Fourth Division, and dated from Chattanooga, Tenn., citing the above facts, and stating that the writer had arrested the guilty party, and recovered the funds, which we found enclosed. When the immense number of letters which pass through the mails is considered, this regaining of a single missive, the abstraction of which had probably been carefully concealed, exhibits a brilliant piece of detective ability, which redounds highly to the credit of our postal service.

TEMPERATURE OF IGNITION OF CHARCOAL.

Some months ago, as our readers will remember, an interesting discussion arose in our columns in reference to the possibility of igniting charcoal or over-seasoned wood, by the heat radiated from steam pipes. A well known engineer stated that he had collected conclusive evidence, proving the possibility of fires occurring in consequence of the ignition of wooden beams by contact with steam pipes, in cases where the wood had lain for a long time in contact with the pipe, and had thus been submitted to a process of charring at a very low temperature. We stated at the time that we were not convinced of the possibility of such action by any evidence which had then been given, and asked for more proof.

It is a well known fact that the lower the temperature at which charring occurs, the lower the temperature of ignition. The question is, however, whether the temperature of charring can ever become so low as to cause the temperature of ignition to become equally low, or nearly as low. In such cases as were above referred to, it was supposed that the wood lay in contact with the steam pipe for months, or even years, and that finally the wood, having become thoroughly charred, actually took fire at steam heat.

We have some evidence which has just been received, which may assist in settling the question, and in setting at rest the apprehensions of the authorities of our insurance companies, who are now acting upon the assumption that the possibility of this source of fire is so well supported by evi

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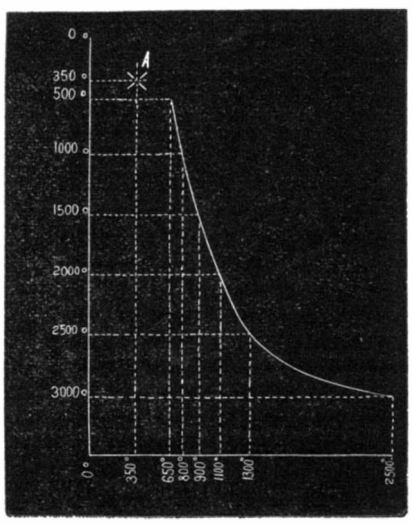
dence that they are justified in imposing very severe restrictions upon the use of steam pipes.

Mr. Robert Harper, some time ago, contributed, to the collection of the Engineering Department of the Stevens Institute of Technology, a piece of wood, which, as he states, "stood during sixteen years and one month on top of and in contact with a one inch steam pipe, containing steam at fifty pounds in cold weather, used for warming the First United Presbyterian Church of Hoboken, N. J." The wood seems to be spruce. It is well seasoned, but no sign of injury or of charring is perceptible, and there is nothing to indicate that it might not have remained on the steam pipe an indefinite length of time without injury.

The accompanying diagram is interesting, and gives valu-



able evidence in this connection. We gave, at the time when this subject first came up, a table showing the temperatures of preparation and the corresponding temperatures of ignition of charcoal for a wide range on the scale.

Mr. Stahl, a student of the graduating class of the Stevens Institute of Technology, has prepared for us, at the request of Professor Thurston, this diagram, in which the vertical scale is one of temperatures of preparation and the horizontal scale is one of temperatures of ignition, and the curve shown contains the points of correspondence as given in our table.

It will be seen that the curve is apparently nearly hyperbolic. The lowest temperature of preparation was 500° Fah., but it is seen at a glance, even that at 350°, the temperature of steam under a pressure of over 125 lbs. per square inch, the temperature of preparation and of ignition cannot coincide unless some marked change of law should occur at so low a temperature, carrying the curve, which here represents that law, abruptly inward to reach the point A. We need hardly state that such a phenomenon would be quite improbable, and is probably impossible. Our readers will find this little diagram very interesting and instructive.

SCIENTIFIC FACTS AND SPECULATIONS.

Addressing a Glasgow society the other day—his subject being the relations of Science to religion—the Earl of Shaftesbury was pleased to be very patronizing to Science. No possible harm could come to his hearers' faith, he assured them, through the advancement of true Science. The speculations of scientific men might be misleading and mischievous, but facts never; and the function of true Science was simply the observation and registering of facts. Therefore, if he had the wealth of Glasgow, he would send fifty thousand pounds to Max Müller to help on his explorations at the fountain head of Aryan civilization. The learned professor's opinions on many things were far from sound; nevertheless, he was doing good work and ought to be encouraged. For like reasons, this champion of English orthodoxy would send another quarter of a million dollars to Professor Tyndall, and say to him: "Accumulate your facts; I don't care about your theories, but turn your powerful intellect to the pursuit of facts."

The evil that men do lives after them; and probably the worst legacy left by Francis Bacon—that pretender in Science, time-serving politician, insidious lawyer, corrupt judge, treacherous friend, and bad man, as Dr. Draper justly styles him—is this very theory of Science which Earl Shaftesbury echoes. According to this school of superficial thinking, the man who turns his powerful intellect to the recording of the temperature of the air, the direction of the wind, and the state of the sky three times a day is a meteorologist worthy of the name; but the man who leaves the recording of facts to other men, or to automatic machinery, and busies himself with suggesting and testing hypothetical interpretations of the recorded facts is a mere theorist, not to be acknowledged by "true Science." Similarly, the greatest astronomer is he who makes the greatest number of observations and discovers the most asteroids or comets; the greatest geologist, he who finds the most fossils. To seek the law within the law, by investigation guided by hypothesis, is to destroy one's right to the title of a true son of Science!

It is the fallacy of the French Academy, which rejected Darwin as an unscientific theorist because he turned from the blind accumulation of facts to the development of an hypothesis whereby to account for the facts. The very important truth that Darwin's hypothesis had given life to millions of otherwise fruitless facts, and still more had given purpose and direction to the observations of hundreds of naturalists, thus accomplishing more for the substantial enrichment of natural history than all their Academy had ever done, was ntirely overlooked.

We are far from deprecating the accumulation of facts. No great truth was ever discovered without them, and the masters of Science have ever been zealous in their pursuit. But their service to Science did not end in barren observations, nor were they made at haphazard. In every case where great discoveries were the result, point and purpose were given to their investigations by hypothesis. Indeed, there can be no true inductive investigation without a marriage of hypothesis and experiment; and it is by such investigations only that Science has come to be what it is. The secret of the successful career of Faraday lies not less in his fertility in inventing hypotheses than in his patient observation and conscientious determination to prove all things. Without his genius for guessing, he would never have been able to add so much to our knowledge of electricity and magnetism. The first observer of the transit of Venus tells how he tried theory after theory, in order to discover one in accordance with the motions of Mars. So, too, Kepler submitted guess after guess, hypothesis after hypothesis, to computations of infinite labor, in determining the laws of planetary distance and motion. The writings of every great man in Science afford confirmation of the necessity of hypothesis in the pursuit of facts, as well as in the pursuit of scientific truths. But probably there cannot be found in the whole history of Science a more striking example of the worth of investigation guided by hypothesis, and the worthlessness of investigation without such guidance, than is afforded by the labors of Sir Isaac Newton. In his case we may see a great man studying chemistry, unaided by any theory: studying the phenomena of light under the influence of an utterly erroneous hypothesis: and again, incited by a bare suspicion that the attraction of the earth might extend as far as the moon, spending his ripest years mathematically testing hypotheses of the most stupendous reach, having for their object nothing less than the laws of the physical government of the solar system, if not of the Universe.

It is easy to imagine how a patronizing Earl of Shaftesbury, a brother alchemist, a Baconian philosopher, might have reproached him for wasting his precious time in theoretical investigations, advising him to stick to his laboratory and bend his powerful intellect to the accumulation of facts. But what says history of the days and nights which he spent in his laborious chemical experiments?

"While his hypothetical and deductive investigations have given us the true system of Nature, and opened the way in almost every one of the great branches of natural philosophy, the whole results of his tentative experiments are comprehended in a few happy guesses given in his celebrated 'Queries.'"

Aided by the insight into the principles of Nature which chemical theory affords, the student of to-day is able to discover more useful facts in a year than Newton could in a lifetime. So it is in every department of Science; and though weak men are apt to mistake hypothesis for final truth, resting on it instead of using it as a means of further progress, the hypotheses formed by powerful intellects are the stepping stones of true Science, without which there could be no advancement. If it were possible and necessary to confine our great men to one department of their work, we should therefore say, not "accumulate facts," but "give us theories. There are men enough, of smaller caliber, to observe and register: men enough to test your hypotheses and to follow their lead; do you give us theories. The guesses of genius are more valuable than the demonstrations of mediocrity."

Fortunately, however, there is no great need of such division of labor. Genius for sound hypothesis is very apt to be seconded by superior skill in devising means for subjecting hypotheses to the test of experiment.

SEEING THROUGH COLORED GLASSES.

A child, or an adult not accustomed to critical observation, looks through a bit of colored glass, and straightway declares that it makes everything green, or blue, or red, as the color of the glass may be. The first impression is that the glass somehow throws a flood of colored light upon the scene; and such, for many ages, was the universal belief.

The ancients explained the phenomena of sight by supposing that the eyes shot forth rays which passed through space to the objects seen: that they saw by means of these rays, much as one might explore by touch the bed of a pond by using material rods. From this standpoint there could be no apter explanation of the action of colored media than to say that they changed the character of the rays proceeding from the eye, and so changed the aspect of the objects looked upon through such media. Nearly eight hundred years ago this view was shown to be erroneous by the Mohammedan philosopher Alhazen, who taught the true theory, since adopted by the christian world, namely, that the light proceeds from the object to the eye. The old theory is practically forgotten; yet its influence is still seen in common speech. To most people a colored glass colors a landscape by adding color to it, though it is well enough known that it really takes more or less away from the color of the several objects, or at least the most of them. Even educated people will say that a green glass, for example, gives its color to objects seen through it. More than that, they will say, as Professor Clifford does in his able essay on the Philosophy of the Pure Sciences, printed in a late number of the *Contemporary Review*, that a colored medium will give its color to *everything*. Thus: "If a man had on green spectacles, he would see everything green. And if he found out the property of his spectacles, he might say with absolute certainty that everything he saw, without exception, would be green."

Surely Professor Clifford can never have looked through a pair of green spectacles! It is equally sure that he could have given no thought to the actual phenomena of color in writing the illustration we have quoted, else he would have stayed his hand. Even if it were possible to make a glass which would be transparent to all green rays and opaque to all others, the asserted result would not happen. All things would not look green through it, but only those which emitted or reflected green light. All objects colored red, orange, yellow, blue, violet, or showing any combination of these hues, would furnish no rays capable of passing through the supposed glass, and would consequently look black, not green.

But the transparency of colored glasses is marked by no such exact chromatic limits, so that the effect of them is still less likely to be as Professor Clifford assumes, as any one may readily see by looking through a pair of green spectacles. If the observer has paid but little attention to the matter before, he will be surprised to see how slightly the natural aspect of things is affected by the glasses. Still more will he be surprised to see how many objects show neither their natural tint nor the tint of the glasses, but a color bearing no apparent relation to either. We happen to have on our table samples of red, green, and blue glass. Probably the colors are as perfect as glass can be made to receive, yet neither specimen shows a pure color. For instance, all allow a little yellow light to pass through them; the green transmits blue rays quite freely, and the blue glass fails to arrest some of the red rays. Seen through the red and green together, the golden clouds above the setting sun show a pale canary-yellow tint, and so does a bright white cloud in another part of the sky. Through the blue glass, the golden clouds have a fainter hue, approaching orange, yet are distinctly visible. The clouds change to orange, then to red. No change can be observed through the green glass, save a gradual fading, the clouds becoming invisible when they have attained their brightest tint of red, the green glass being opaque to all rays below the yellow. Through the blue glass, however, the reddening sky grows purple, the final hue being exceedingly rich and beautiful. Through the red glass, the sky appears lurid, like the reflection of a great fire. The blue glass seems perfectly opaque only to green and yellow; the green is opaque to red rays alone, the red glass to green only.

These observations give a clue to the changing hues of colored objects when looked at through the several glasses in bright daylight, a few instances of which may be cited to show how widely Professor Clifford's assertion varies from fact. The salmon-colored cover of the *Contemporary* looks yellowish brown through green glass, and a dead brown through blue. Through the red it shows the palest possible orange tint. A yellow envelope shows a brighter yellow through the green glass, bright orange through red glass, and salmon color through blue. Some cherry colored silk appears a lustrous brown through green glass, pale pink through red, and an almost invisible purple through the blue. A piece of light blue silk appears a light drab through green glass, a pale brown through red, and bluish gray through the blue glass. A red spot in the carpet seems brown through green, pale red through red glass, and wine color through blue. A deep green band on a water pitcher shows lead color through the green, slate color through red, and brown through blue. Curiously, any color in the glass, instead of enhancing, as one would naturally suppose, the corresponding color in objects, invariably makes it less bright and clear. It is only as objects emit or reflect white light that their color approaches that of the medium through which they are seen.

Single Rail Steam Towage on the Belgian Canals.

We learn from the *Moniteur Industriel Belge* that a system of steam towage is about to be established on the Bourgogne canal, over a distance of about 150 miles. The tow path will be laid with a single rail weighing some 16 pounds to the yard, and fixed on traverses placed 3·2 feet apart. The locomotive has four wheels, two of which are placed directly along the axis of the vehicle, one in advance of the other, and two, one at either side. The former pair are directing, the latter driving, wheels. The directing wheels are grooved, and fit the rail: the others have rubber ties which give purchase on the macadamized road, and which press thereon only to the extent of 0·07 pounds per square inch. By means of simple mechanism, the weight of the machine may be thrown either upon the driving or directing wheels at will. In the first case the maximum and in the last the minimum of adherence is obtained, to suit the conditions of a loaded or an empty boat. A single road is to be used, with relay engines provided at suitable distances. Each locomotive tows one boat; and when a meeting takes place of two traveling in opposite directions, the engines change boats and retrace their paths.

This single rail system has already been satisfactorily tested for short distances on the Belgian Canals, and the projector, M. Larmangat, has obtained a government concession for its extended construction for forty years. The locomotives are to weigh 4 tuns each, and will travel at the rate of 3·1 miles per hour, with full boats carrying, a cargo of 150 tuns each.

Proposed Utilization of the Hudson River Sources.

The Legislature of New York, last year, ordered a survey in order to determine whether the immense accumulation of water on the great Adirondack plateau could be held in reserve and drawn upon as needed for State purposes. A report on the subject has recently appeared, from which we learn that this storage can be safely and economically effected. At the present time this water runs to waste, and is productive of much damage during the spring freshets. If confined, it could be obtained in sufficient quantities, when needed, to supply deficiencies in the river during the dry summer season for at least one hundred days.

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THE UNDERGROUND RAILWAY, NEW YORK CITY.

NUMBER VII.

Continued from page 402.

The centering for the great 68 feet arch near 95th street, shown in the engraving in our last article, page 402, was put up and the arch turned while the trains were constantly passing and repassing beneath it. The centering was of itself a considerable work. In Fig. 17 we give an elevation thereof. It consists of a series of frames or ribs placed 5 feet 6 inches apart, from side to side. The back piece of the frame consists of two polygonal frames of boards 9 x 3 inches, so arranged that the boards of one frame break joints with those of the other, the joints, as usual, being in the direction of the radius of curvature, which, for the intrados of the 68 feet span, is 44 feet 5 inches. The back piece is strengthened and prevented from spreading laterally by a compound horizontal tie beam, composed of four beams 10 x 3 inches, placed in pairs and joined a little to one side of the center by a spliced joint, as shown in Fig. 17. This tie beam is placed a little above the springing line. Quite close to the crow is also placed a straining beam, 6 x 6 inches, single, supported by two inclined struts, 8 x 6 inches, single. The long horizontal tie beam is connected with the back piece by one vertical and four inclined ties, each composed of two pieces of timber which clamp the back piece and tie between them. The dimensions of the beams of the vertical tie, which is placed in the center of the span, are 9 x 2 inches, and those of two of the inclined ties, 9 x 3 inches. These ties are braced by single beams, 6 x 6 inches and 8 x 6 inches, placed in such wise as to convey the pressure on the back piece directly to the points of support of the frame. These supports are so arranged as to leave sufficient room for the passage of trains. They consist of three beams for each end of the rib, two vertical and one inclined. One of these, 6 x 6 inches, is placed upright against the abutment, a horizontal beam 3 x 5 inches, on which the end of the back piece rests. The other vertical support, 10 x 6 inches, single, is placed nearer the center of the tunnel, and rises to the back pieces. The inclined shore, 12 x 6 inches, starts from the foot of this latter shore, and rises to the under side of the horizontal tie, where it abuts against a straining beam 4 x 6 inches, placed underneath this latter. These shores are strengthened by string pieces, 2 x 9 inches, double, and rest upon a sill placed transversely to the axis of the tunnel. Under this sill, and resting upon longitudinal timbers, 8 x 6 inches, are the wedges (three sets for each end of the rib) by which the frame is keyed up. The laggings are 3 inch plank.

The frames are braced together by two beams, 8 x 12 inches, placed horizontally across the upper side of the horizontal tie beam, and also by six other beams (three for each end of the rib), placed, one along the backs of the vertical shores, and two along the backs of the inclined shores. On the outside of these latter supports are placed inclined beams, 8 x 6 inches, which bind the frames in sets of three, the beam passing from the foot of the shore of one rib across the middle of the shore of the second to the top of that of the third rib. From here another beam passes to the foot of the sixth rib, and so on. The ribs at the end of the tunnel, where the span is fifty feet and the radius of the intrados 31 feet, differ from the ribs just described in that they want the vertical shores and the ties joining it with the back piece. The inclined shore in this case rises from the foot of the abutment.

The rock tunnels commence at 92d street and extend to the north side of 94th street, a distance of some 550 feet. It will be remembered that at this point on the road was the old rock tunnel. This tunnel now forms the large central tunnel, and on each side of it was excavated a single tunnel. The three tunnels as they now exist are shown in cross section in Fig. 18. The two single tunnels are 18 feet high from the railroad grade to the top of the arched roof, and 18 feet 8 inches wide at the bottom: or, allowing 32 inches for the thickness of the two side linings, the span becomes 16 feet in the clear, and the hight 16 feet 8 inches. The arches are semi-circular. Their center is 36 feet east and west from the center of the central tunnel. This latter has a span in the clear of 27 feet; and as the side tunnels have each a span of 16 feet, we have, for the thickness of the rock walls separating the side and central tunnels, 14 feet 8 inches. The middle tunnel is unlined, but the face of the rock is trimmed off to a very fair degree of smoothness. The two side tunnels, however, are each of them lined with brick 16 inches thick, and the space between the rock and the brick filled in with concrete.

The ventilation is effected through circular shafts sunk over the summits of these tunnels, at the usual distance apart. These shafts are lined with brick 16 inches thick, and are 6 feet in diameter in the clear, and coped on top with pene-hammered granite coping 10 x 18 inches, surmounted by an iron railing. During the excavation of the tunnel, these ventilating shafts served also as working shafts, the headings being carried forward north and south from the bases of them, and the excavated rock raised to the surface by a small steam engine.

The blasting was done in the most careful manner, the charges in the neighborhood of the dividing wall being so regulated as not to injure them in any manner. The drilling was done partly by hand and partly by steam, and the amount of rock thus excavated was, in the tunnels, 25,406 cubic yards; in the open cut, 37,200 cubic yards.

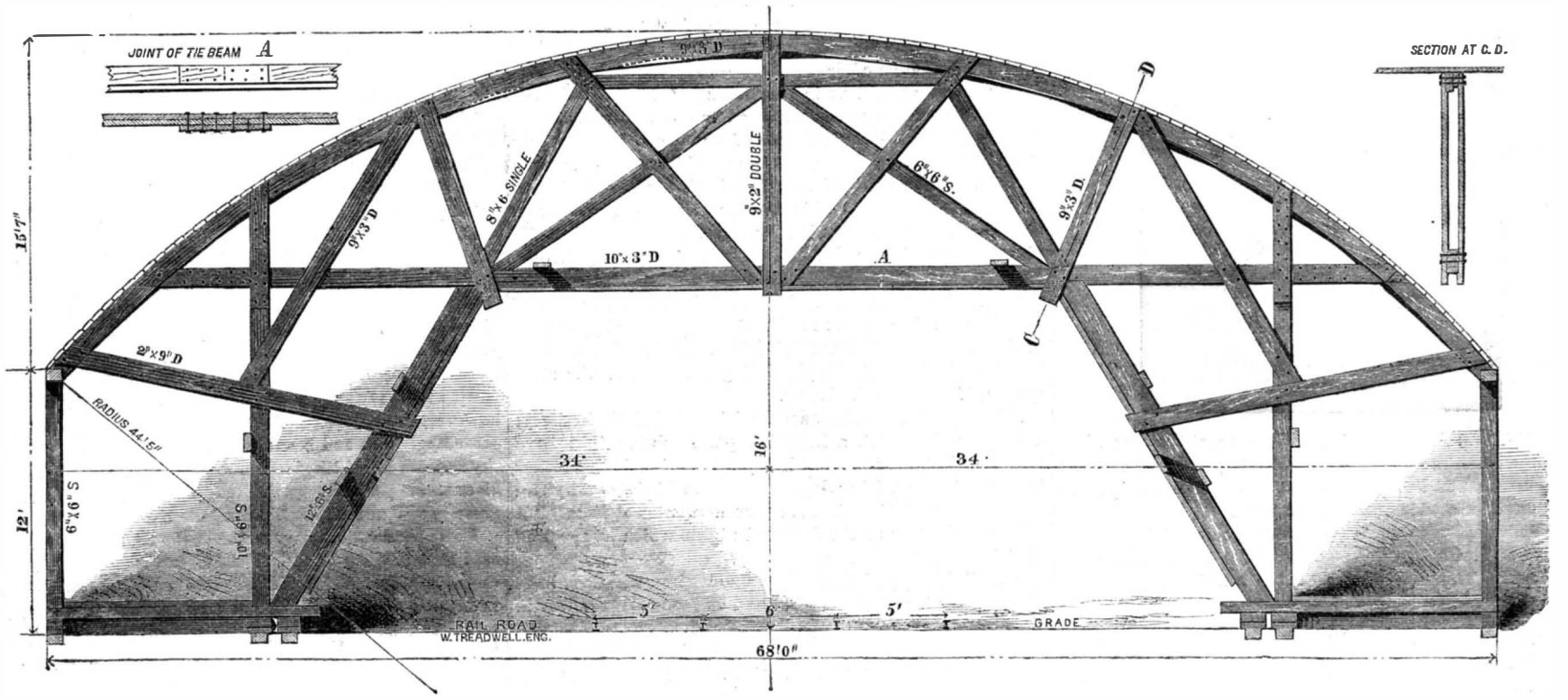

Fig. 17.—THE UNDERGROUND RAILWAY IN NEW YORK.—CENTERING OF THE GREAT ARCH, FOURTH AVENUE, NEAR 95th STREET.

Singular Cause of a Boiler Explosion.

The tube of a boiler recently exploded in a foundery at Liège, Belgium, caused, as shown on examination, by the corrosive action of ferrous sulphate and sulphuric acid, derived from the sulphur in the coal fuel. The discovery strongly points to the necessity of carefully and frequently cleaning the forward portions of the boiler tubes, and other parts which do not come in direct contact with the flame.

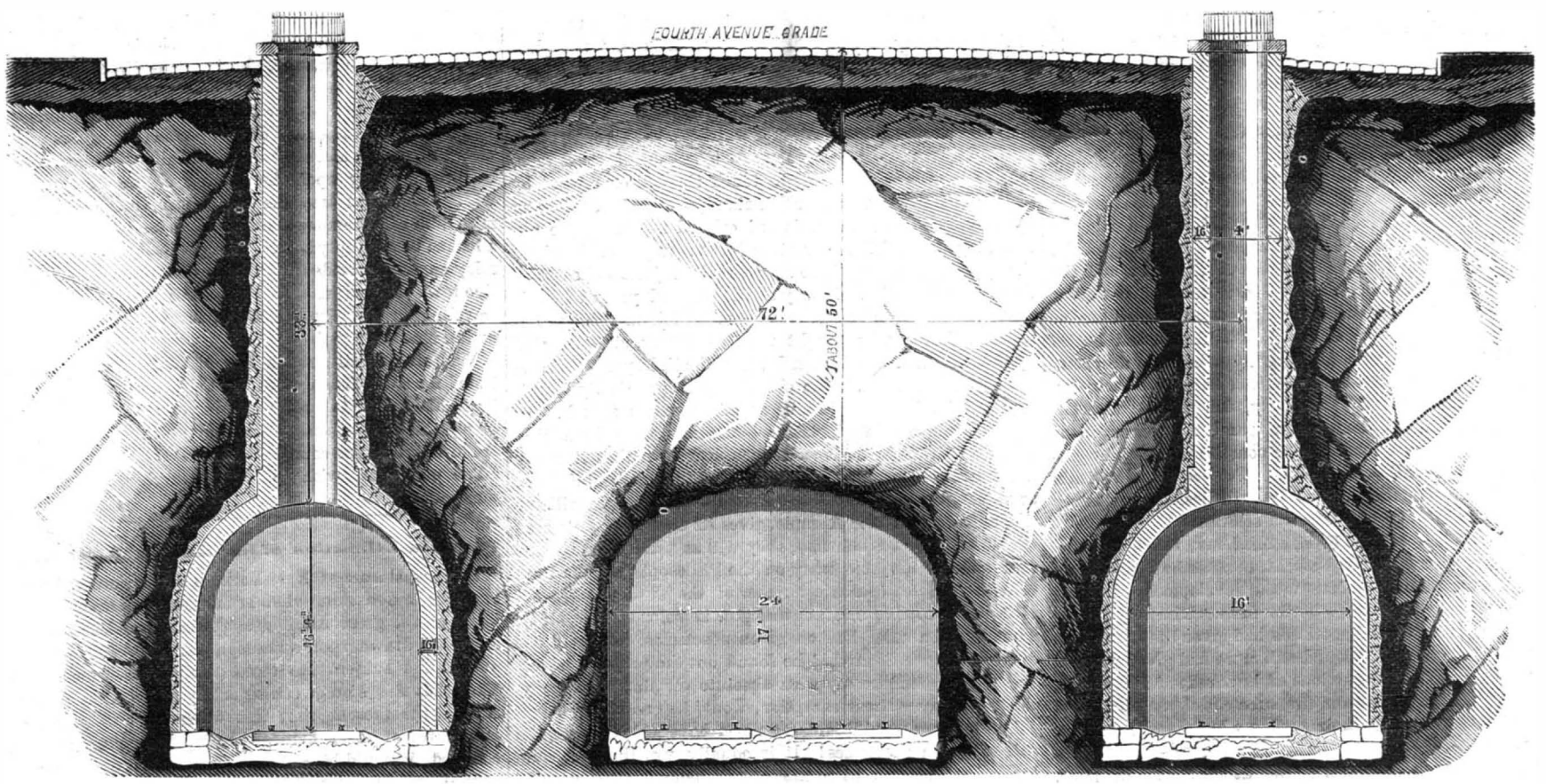

Fig. 18.—THE UNDERGROUND RAILWAY IN NEW YORK.—THE ROCK TUNNELS, FOURTH AVENUE, BETWEEN 92d AND 94th STREETS.

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ROAD AND FARM LOCOMOTIVES AND STEAM ROAD ROLLERS.

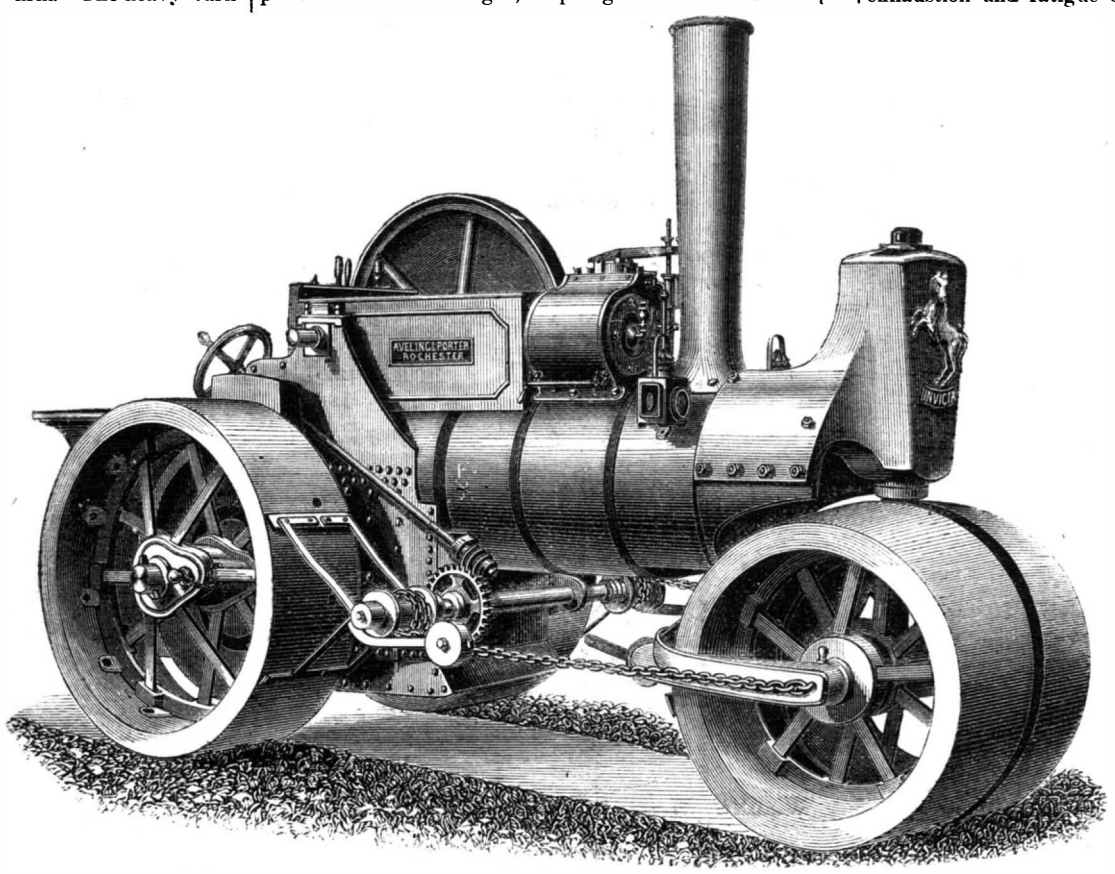
The newest types of Messrs. Aveling and Porter's steam road roller and road and farm locomotives are illustrated on this page, the steam roller particularly presenting many improvements when contrasted with the well known roller of Messrs. Aveling and Porter's manufacture which has already been illustrated in the SCIENTIFIC AMERICAN. As nearly as practicable, the steam roller is now made to conform in design and construction to the successful and extremely simple road locomotive of this eminent firm. The heavy turn-table and steering apparatus of the old pattern roller is avoided, and the weight thereof is added to the rolling wheels, the thickness of whose tyres is now 1½ inches, instead of 2¼ inches, as heretofore. The durability of the wheels is thus increased twofold. One man only is required for the entire control of the roller, in place of two, and the running expenses, including coal, oil, and wages, are by this arrangement reduced to six dollars per day for the 15 tun size. The consumption of fuel is less than in the old style of roller; the boiler and engine are larger and more powerful; the number of wearing parts is fewer; and moreover, the first cost of the machine is materially less.

Now that the steam roller has become a recognized necessity in the practice of good road making, this improvement and reduction in cost will be acceptable to the large number of corporations and contractors requiring such machines.

The engraving of the road and farm locomotive is taken from one of Messrs. Aveling and Porter's recent manufacture. In general construction it does not differ materially from the engine of this firm which gained the first prize at the latest trials of traction engines by the Royal Agricultural Society of England. In some of its minor details, alterations have been made which add to the success of the locomotive. Messrs. Aveling and Porter have built upwards of a thousand road and farm locomotives, and they have gained first prizes with them at the International Exhibitions of London, Paris, and Vienna.

The variety of uses to which these locomotives are applied, including plowing, thrashing, and the removal of heavy material, induces a large and extensive demand, which has never been so great as at the present time. Mr. A. T. Stewart, at his Garden City, Long Island, has adopted the Aveling and Porter road locomotive, and it's success has been remarkable in plowing, thrashing, hauling, and the uprooting of large trees. Mr. Hinsdale, Mr. Stewart's manager at Garden City, speaks very highly in its praise.

Messrs. Aveling and Porter's agent in New York city is Mr. W. C. Oastler, 43 Exchange Place.



AVELING AND PORTER'S STEAM ROAD ROLLER.

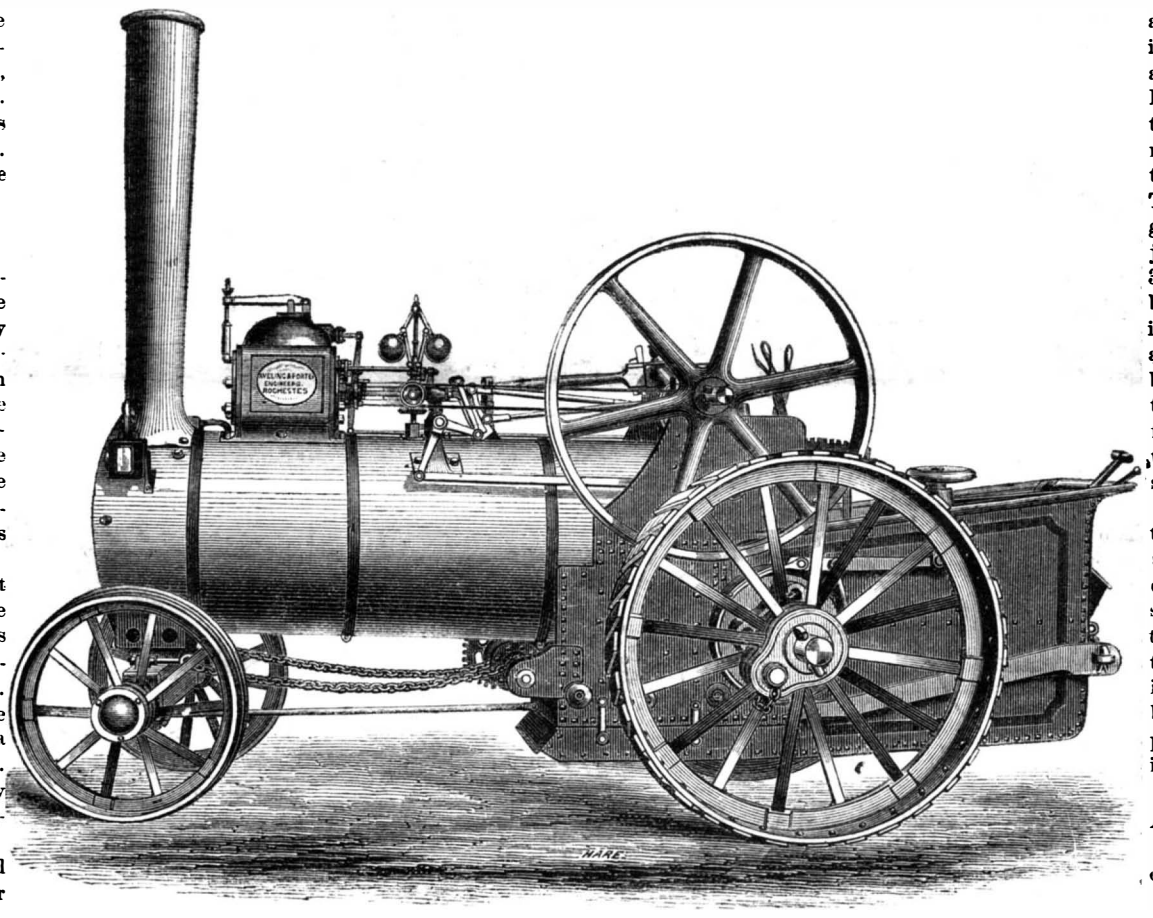
Gas from Sewer Refuse.

A novel and apparently important utilization of sewage has recently been successfully put in practice in Breslau, Germany. Mr. Alfred Sendermann announces that from this waste he has obtained an excellent illuminating gas, and this on a scale sufficiently great to warrant the belief that the plan might be extended to meet the requirements of large communities.

The apparatus, which is built underground, consists in a large reservoir in which the material is collected and thence run off to retorts located at a still lower level. The gas is here generated in the usual way, and conducted to a tar cistern and then to a condenser. The purification is effected by milk of lime, and finally by passage through clean water.

The gas thus obtained is said to burn with even a brighter flame than that made from coal. Its odor is slightly acid, but not at all disagreeable.

The common residues, such as coke, tar, and fatty matter, are inodorous and perfectly utilizable. The cost of the apparatus is no dearer than that of the ordinary description, while the expense of the product is necessarily less than that of coal gas. There is no disengagement of bad odor from the factory. If these claims are legitimate, several important sanitary problems will be solved by the invention.



AVELING AND PORTER'S ROAD LOCOMOTIVE.

Fish as Makers of Oxygen.

Dr. Moreau has recently investigated the facts indicated by Biot, from which it appears that the gas contained in the natatory vessels of fish is nearly pure oxygen. Dr. Moreau has verified this, and has also discovered that, when other gases are found in the vessel, such as nitrogen, their presence is due to accessory causes. In order to prove this view, he examines fishes which had existed for a long time in shallow water. These, after determining by many analyses the quantity of oxygen which they had secreted to be about 16 per cent of the vesical gas, he plunged into water of a depth of some 25 feet. Submitted under these new conditions to a much higher pressure than before, the fish, to counterbalance the same, augmented the quantity of gas contained in the natatory vessel. Analysis of the gas then showed an increase in oxygen to 25 per cent, showing that the cause of the augmentation was clearly a secretion of that gas in a pure state.

A Noble Bequest.

Ex-Mayor T. M. Allen, of Hartford, has offered to give that city $100,000 for the establishment of a free industrial school for the instruction of boys and girls in the business avocations of life—agriculture and the mechanic arts. He suggests that every boy, while he is acquiring a knowledge of the arts, sciences, and modern languages, should become a practical agriculturist and master of some useful trade, and that the girls should be instructed in all the practical duties of the household, understand and become familiar with the chemistry of the kitchen, and made to master the art of making every article of a lady's wardrobe, and also that they learn bookkeeping, banking, telegraphy, photography, or any other occupation that is within the measure of their strength and adapted to their tastes.

The Overworked Man of Business.

The London *Sanitary Record*, in an interesting article on "Overwork," gives the following graphic picture of the business man who is overtasking his powers:

"Sooner or later he finds that his day's work has become an effort, a toil rather than a delight; the last hour has become a strain only maintained by determination; a sense of exhaustion and fatigue envelopes his closure of the day's work, and the last columns of figures have presented difficulties hitherto unknown, and the last pile of letters has seemed more trying than of yore. Anything new, of an unwonted character, making special demands upon the higher faculties, becomes arduous and distasteful, revealing the fact that the higher powers are first commencing to give way, to announce their inability; while the more routine matters, which have almost become automatic, or even habitual, can still be effectively discharged. But in time even these lower processes are affected, and the last half hour at the office is a distinct trial, and is followed by a new sense of exhaustion. There is a certain amount of irritability combined with the sense of exhaustion, that irritability which is ever found along with the exhaustion of nerve matter; this irritation, sometimes almost amounting to exaltation, marks the commencement of nervous exhaustion and failure. While work seems to become more irksome, the usual sources of pleasure no longer afford their wonted solace and satisfaction. There is a heightened susceptibility to any little trivial annoyance, domestic matters are felt more keenly, the dinner is not so satisfactory, the children are noisy; the more necessity for rest, and the more distinct the craving for comfort and quiet, the less seems forthcoming. There is an emotional exaltation which reveals the irritability of the exhausted nerve centers; the newspaper is stupid and uninteresting, the piano wants tuning, servants are deteriorating, children are less obedient, and wives less sympathizing than of yore. The mind is as sensitive as is the skin after a blister; the slightest touch produces pain."

The Sandy Hook Ordnance Experiments.

The experiments with the ten-inch Rodman smooth bore gun, which has been altered into an eight-inch rifled piece by the insertion of a wrought iron core, are still in progress at Sandy Hook. It is intended to subject the weapon to the test of 500 rounds; and up to the time of writing, 400 rounds have been fired. The charge used is 35 lbs. hexagonal powder, with a Butler projectile weighing 170 lbs. At the 363rd round, the pressure in the bore was 25,500 lbs. per square inch. Careful examination with a star gage, an instrument capable of noting changes in diameter of the bore of $\frac{1}{1000}$ of an inch, fail to show the slightest variation, and the gun is apparently as strong as when first fired.

It is intended to continue using the piece after the 500th round, until bursting takes place, in order to determine the limit of strength. These results are of the highest importance, since, if the success thus far encountered is continued, some 4,000 smooth bore guns, now in government possession, will be fully trebled in value and efficiency.

Amalgam Fillings for Teeth

"As a durable filling, amalgam can be used," says Dr. A. C. Castle, "in cases where other metallic fillings cannot be applied. Their use has been on the increase for very many years; and where formerly only grains were sold, our most distinguished dental depots now monthly sell pounds of the best American prepared amalgams.

Opposition to their use is made by those only who seek to obtain fabulous fees for gold fillings, which cannot be obtained for these, and hence appropriate to themselves the title of "the best dentists." In the appropriate places I have used amalgams for forty years past. No injury, above electro galvanic action, has been done by their presence."

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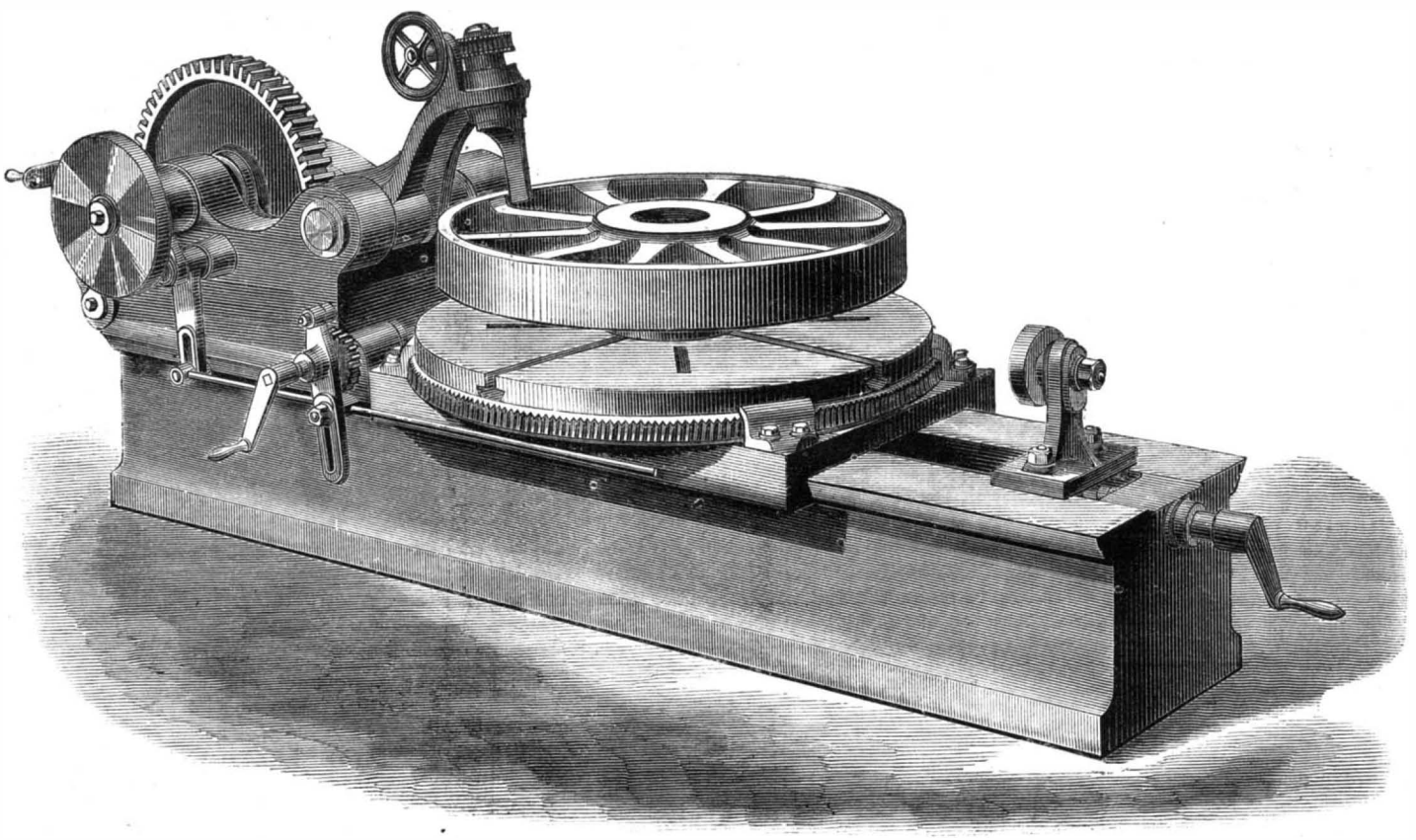
FINISHING LOCOMOTIVE WHEELS.

It has of late years become the custom—and a very good one too—to bestow much greater care upon the finish of locomotive engine wheels than was formerly the case, and, as a result, several special machine tools have been introduced for the purpose of trimming off wheels, which in Europe are universally f wrought iron, and thus saving hand labor.

We illustrate a machine for this purpose by Mr. F. W. Webb, locomotive engineer to the London and Northwestern Railway Company. It is a curvilinear slotting machine, and the tool is mounted in a holder provided at one end of a vibrating lever, the other end of this lever being slotted, and being fitted with a sliding block, into which the pin of a disk crank enters. As the crank disk revolves with its upper edge approaching the fulcrum of the lever, the effect of the arrangement is to give the tool holder a slow downward and a quick return stroke. The point of the tool, of course, describes an arc of a circle struck from the center of the vibration of the lever, thereby producing a convex form on the inside of the tyre, and so giving additional strength to the rim. The wheel bed plate is revolved by suitable automatic mechanism, as shown, somewhat similar to the devices ordinarily employed in planing machines. Provision is made for wheels of any diameter, by means of the crank and screw shown on the right of our engraving.



WEBB'S WHEEL FINISHING MACHINE.

WOOL WASHING MACHINERY.

In scouring wool, the operator has to insure that a constant supply ot the washing fluid be continuously and intimately brought into contact with the material, and that a plentiful supply of rinsing water be at hand. To this end, the washing machines are constructed with several cylinders, that the wool may be repeatedly washed and rinsed. This system is known to the trade as "the leviathian," and the apparatus has been frequently improved in form and efficiency till last year, when Messrs. J. & W. McNaught, of Rochdale, England, exhibited at Vienna the machine of which we publish an engraving.

Fig. 1 represents the machine, used as a single self-acting wool washing apparatus for smaller quantities of wool, while Fig. 2 shows the transferring apparatus provided for carrying the wool from one washing reservoir to another in a series of machines. The arrangement of the working parts of this apparatus will be easily understood from the engravings. The washing reservoirs are provided with double bottoms, and are connected with each other by the tube, H, through which the washing fluid can pass from one reservoir to the other; this movement is effected in a peculiar manner, a steam injector being fixed in the tube, H, the steam jet of which, when acting, forces the fluid, through H, into the first reservoir, from whence it can pass back again into R as soon as it has reached the hight of the communicating pipe. The wool is put in motion in the reservoirs by means of swing rakes, which are moved in the manner shown in our engraving.

The transferring arrangement for the wool is as follows: The rod, *u*, is jointed to one end of the link, T, while the other end of this link works on an adjustable center carried by a slotted bracket, *b*. The lower end of the rod carries rakes, A, which pierce through the wool, while a bush connected with the crank, *r*, the axis of which is put in rotation by wheel gear, can slide along the rod, *u*, whence the rotation of *r* produces an elliptical motion of the points of the rakes, A; the larger axis of this ellipse is in the direction of the motion of the wool, and the points of the rakes are through one half the curve in connection with the wool, and travel forwards, while they rise above the wool and travel backwards through the second half of the curve. The rakes which carry the wool forward through the troughs are similarly arranged; and at the point of contact of each of the curves described by the four systems of rakes, as shown in Fig. 1, fixed rakes are provided, through which the wool is pressed on one side and caught on the other side by the descending rakes of the next system,

Fig. 1.

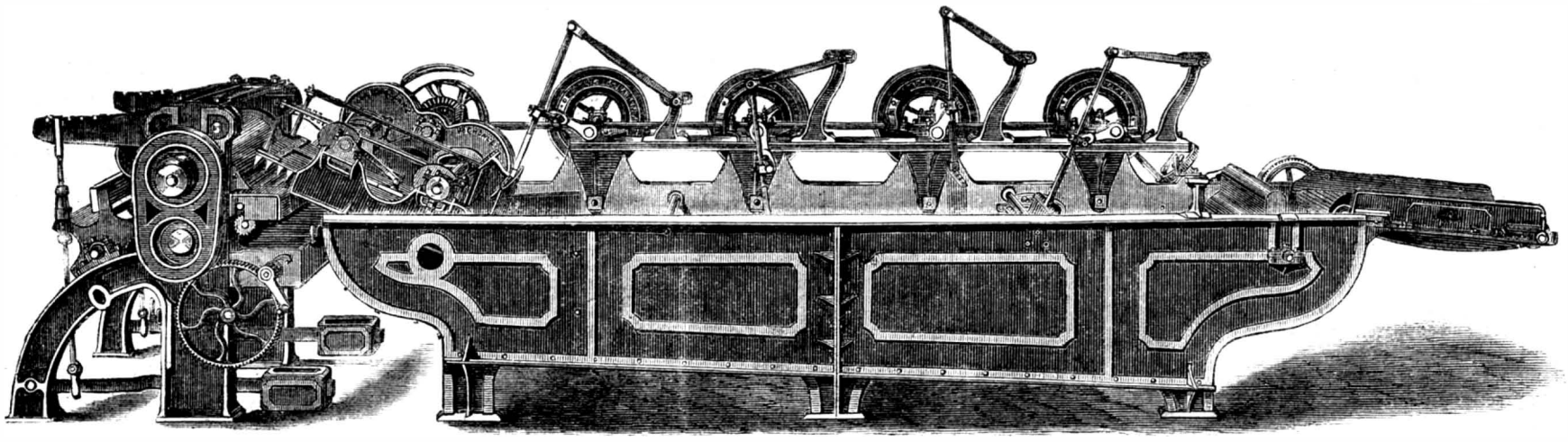
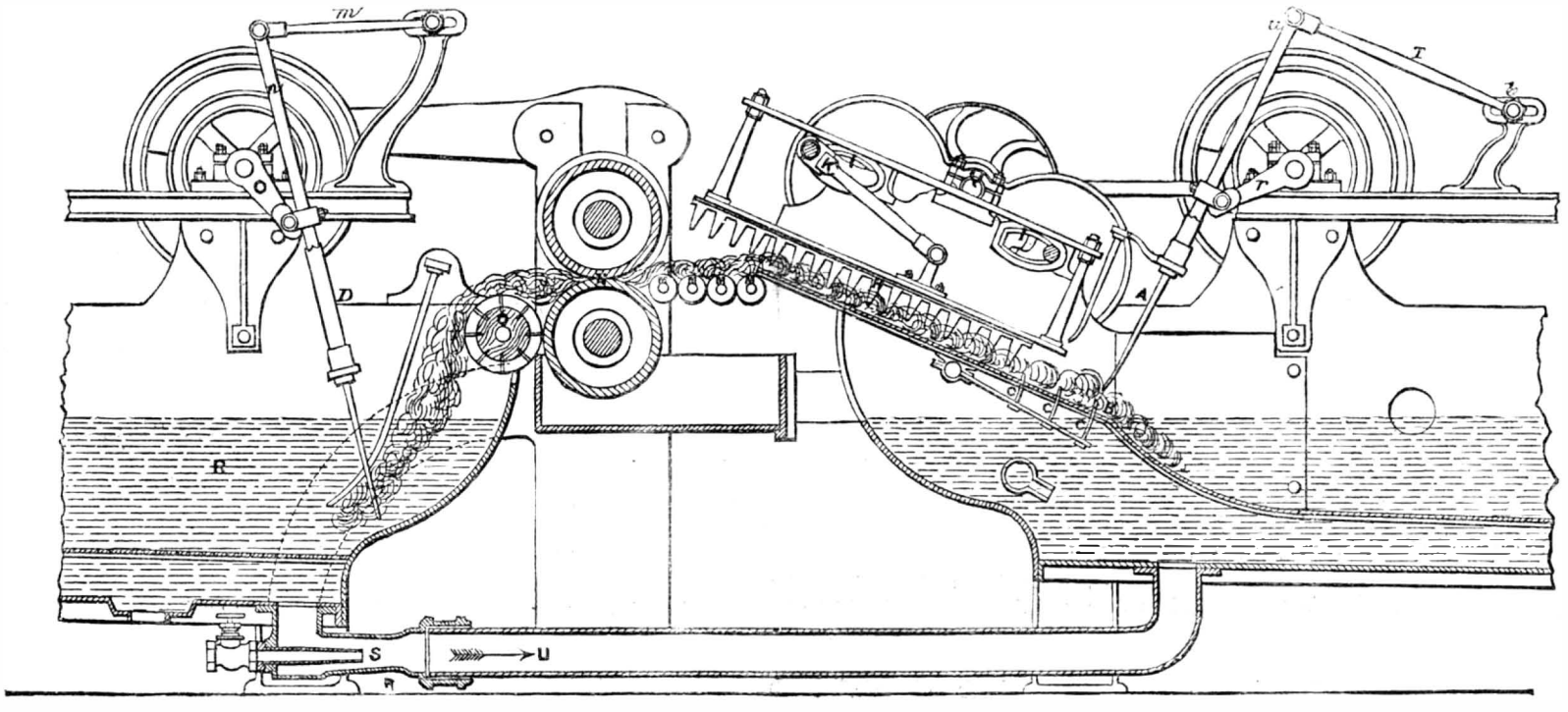


Fig. 2.



McNAUGHT'S LEVIATHAN WOOL WASHING MACHINE.

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a continuous travel of the wool being thus effected. Returning to the arrangement for transferring the wool from one trough to the next, it will be seen from the sectional view of the transferring apparatus that the last system of rakes carries the wool on to an inclined plane, through which the small rakes, C,C,C, project; these latter hold the wool on the inclined plane, B, when the points of the rakes, A, have to travel backwards. From B, the wool is taken off and carried forwards by a separate apparatus, H, to which a curvilinear motion is also given by the cranks, I, and the rod, K. The rollers, M, M, M, M, carry the material between the squeezers, F, from which it passes either over another roller, as shown, into the following reservoir, where it is at once caught by the rakes, D, worked by the crank, O, and the rods, *n* and *m*, or over a second squeezer or pressing roller to the drying machine, as shown in Fig. 1.

This apparatus for getting the wool from one reservoir into the other, or from the last reservoir through the squeezers to the drying machine, is well designed, and fulfils its purpose perfectly, while the mode of forcing the washing fluid from one reservoir into the other by a jet of steam is very simple, and also gives most satisfactory results.

The inventors provide the self-acting machines (says *Engineering*, from whose pages we extract the engraving) with a feeding cloth and a brass revolving immerser. The squeezers have wrought iron shafts 4½ inches in diameter, and are covered with hemp or wool, and the fixed rakes are adjustable.

NEW SWIMMING BATH IN LONDON.

The public baths and washhouses are a feature in the life of English cities that is worth attention In many of them a bath, with clean towels, etc., can be obtained for two cents; and hot water, use of tubs, and all necessaries for washing linen can be had for two cents an hour. One of the largest of these establishments belongs to the parish of St. Marylebone, and is situated in Seymour Place. It possesses accommodation for some hundreds of bathers and washers, and is very largely patronized.

An important addition has recently been made to this establishment in the form of a large and handsome swimming bath, of which we present an engraving, extracted from the London *Builder*.

The length of the bath room is 85 feet, and the width 41 feet, the hight being 28 feet from the platform round the bath to the apex of the roof. The dressing boxes, averaging 4 feet 3 inches long and 3 feet 6 inches wide, are contained along the sides of the room in recessed arched openings. All the fittings of these boxes are of ebony, and the metal work is electro-plated. The arcading is continued along the end walls, but the recesses here are filled in with ornamental tile work. The piers of the arches have each three panels, filled in with blue hand-painted tiles, with variously designed representations of birds, fishes, and water fowl. The roof is supported by cast iron semi elliptic ribs, ornamented with gilded scroll work panels.

The size of the bath itself is 26 feet by 73 feet, and the depth of water 4 feet 6 inches, shelving down to 6 feet. The spring diving board is 4 feet above the water, but there is another diving board 5 feet higher than this one.

The bottom and sides of the bath are covered with glazed tiling, in variously designed patterns; and the hand-painted tile border above the water line, 21 inches wide, represents the appearance of an aquarium, with fishes and rockwork.

The whole of the interior of the building is decorated with Pompeian ornament. Mr. Raymond Smith is executing the marble fountain, which will be placed at the east end of the bath. The architect is Mr. H. Saxon Snell, and the cost of the building was $21,250

The American Centennial Great Exhibition.

The Financial Agent of the Centennial Board, Ex-Governor Biglow, of Pennsylvania, recently made a speech at Norwich, Conn., upon the prospects of the Centennial, from which we take the following interesting particulars:

The Board accepted the refusal of Congress to grant money as an intimation that they must rely upon private capital or State aid to carry forward the project, and on this basis they have zealously devoted themselves to the work of raising funds, with much success. But they will make one more attempt in Congress to get money from the public treasury in the shape of payments for premiums, police guard, etc.

"I am confident that you must feel especial interest in the present status of this great enterprise, and I shall give it to you in as few words as practicable. The buildings are an art gallery, covering 2½ acres, a main exhibition building, covering 20 acres, a conservatory of 2½ acres, a machinery hall of 12 acres, and the agricultural department of 5 acres, making a total of 42 acres, which, with the space occupied by the zoölogical garden and the cattle pens and grounds for the agricultural tests, will make a vast show. Some months since, the art building and the main exhibition building were contracted for, and the inner walls of the art building are up to the square, and the granite will be all put up during the coming winter; and its completion in time is fully assured. The foundation of the twenty-acre building is nearly completed, and the glass and iron are being prepared with satisfactory expedition, and its completion within the time prescribed may be confidently relied on. The conservatory and the machinery hall will be contracted for within a few days; the agricultural department, which can be completed within a few months, will be commenced in the spring. I say, further, there is nothing in the financial condition of the Board of Finance to interfere with the progress of these buildings. The State of Pennsylvania and the city of Philadelphia have provided for the art gallery; the city for the machinery hall and the conservatory; and the subscriptions to the stock, already secured, amount to about $2,000,000, which sum, with what we expect to get from Connecticut and the other States, will be applied to the main exhibition building and the agricultural department. So you see that the great problem of the buildings is solved. The next inquiry that naturally arises is: Will there be anything to put into these great buildings? I answer, unhesitatingly, an abundance. The space already applied for decides that question affirmatively, and eighteen months still remain before the opening. I know that the Director General, A. T. Goshorn, is already impressed with the great difficulty of restraining the exhibition, that is, to restrain it in quantity so as to elevate it in kind. I have myself, within a brief period, visited all the great cities of the country, and witnessed the exhibitions at Cincinnati, Chicago, Indianapolis, St. Louis, Louisville, Philadelphia, and New York, and have gathered some knowledge of the public feeling; and I feel that I am warranted in saying that in the department of machinery and of the useful arts generally, and in that of manufactures and natural productions, the display will overshadow all its predecessors. The prospect of attendance and display from foreign countries is brighter by far than the Commission had anticipated. The following countries have formally and favorably accepted the invitation of the President to be represented and take part in the coming international exhibition, to wit: Germany, France, the Netherlands, Belgium, Sweden, Norway, Spain, Canada, Liberia, the Sandwich Islands, Japan, Honduras, Ecuador, Hayti, Argentine Confederation, Chili, Mexico, Brazil, Guatemala, Peru, Venezuela, Salvador, Colombia. While Great Britain, Austria, New Zealand, and the Australian islands have adopted no official steps as to ministers, commissions, or appropriations of money, the Director General is in possession of trustworthy information showing that each one of the governments of these countries intends that its subjects shall take part in the exhibition. In ten of the countries named, commissioners have been appointed to care for the articles to be exhibited, and in seven or eight it is known that handsome appropriations have been made to defray the necessary expenses.

I wish I had the precise utterances of Baron Schwarz-Senborn, delivered at Philadelphia a few days since, as to the value of the late Exposition in Austria. He said that manufacturing had received a strong impulse, and that new and special branches had sprung up in and about Vienna; that looked at from this standpoint, the exhibition had been a most judicious investment. I cannot doubt that the Exhibition of 1876 will prove so to our country, for while we may have lessons to impart, there are many more we should accept."

PROFESSOR WATSON, at present one of the members of the transit of Venus expedition for this country, has found a new asteroid. This makes his seventeenth discovery of the same kind.

THE Brooklyn tower of the East river bridge was completed on the 16th of December. Its total hight is 268 feet. It is very imposing in appearance; we hope it will not prove a tower of folly.

ST MARYLEBONE SWIMMING BATH, LONDON, ENGLAND.

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ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for January, 1875.

Mercury.

On the 1st of January, Mercury rises at 7h. 4m. A.M., and sets at 3h. 53m. P.M. On the 31st, Mercury rises at 7h. 57m. A.M., and sets at 6h. 4m. P.M.

Mercury and Saturn will be in conjunction on the morning of the 27th, and must be nearly together in the evening; but they are so far south in declination, and set so early, that it will not be easy to see them.

Venus.

Venus should be looked for in the morning, being west of the sun after the transit.

It rises at 4h. 56m. A.M. on the 1st, and sets at 2h. 46m. P.M. On the 31st, Venus rises at 4h. 13m. A. M., and sets at 1h. 51m. P.M.

Venus attains its greatest brilliancy on the 12th, at which time it passes the meridian a little after 9 A.M., at the low altitude of 31°.

Mars.

On the 1st, Mars rises at 2h. 18m. A.M., and sets at 0h. 47m P.M. On the 31st, Mars rises at 1h. 50m. A.M., and sets at 11h. 38m. P.M.

The apparent diameter of Mars is now very small, and its southern declination is large; of course it is not a good time for making observations on the planet.

Jupiter.

Although Jupiter's relative position is becoming better, it is yet not very favorable to observers. Jupiter rises on the 1st at 1h. 41m. A.M., and sets at 0h. 29m. P.M. On the 31st, Jupiter rises at 11h. 53m. P.M., and sets at 10h. 35m. the next morning. It can be beautifully seen at early morning.

Saturn.

Saturn, also, is far south in declination, rises in the morning, and sets early in the evening. On the 1st, it rises at 9h. 24m. A M., and sets at 7h. 10m. P.M. On the 31st, it rises at 7h. 36m. A.M., and sets at 5h. 30m. P.M.

Saturn and Mercury are nearly in the same position near the last of January.

Uranus.

Uranus is in northern declination among the small stars of *Cancer*. On the 1st, it rises at 7h. 18m. P.M., comes to meridian at 2h. 22m. in the morning, and sets at 9h. 26m. On the 31st, its position is very good. It rises at 5h. 15m. P.M., comes to meridian about midnight, at an altitude of 66°, and sets at 7h. 25m. the next morning.

Neptune.

Neptune is too far off to be seen without the aid of good telescopes. It rises at 0h. 29m. P.M. on the 1st, and sets at 1h. 35m. the next morning. On the 31st, it rises at 10h. 31m. A.M., and sets at 11h. 37m. P.M.

Meteors.

Very bright meteors were seen on the evenings of December 11, 12, and 15. One which passed from the zenith to the southwest, at 8h. 27m. P.M. on the 11th, was so large as to attract the attention of persons who occupied a brilliantly lighted room.

Sun Spots.

The record is from November 16 to December 16 inclusive. The photographic picture of the 16th shows the group of spots seen on the 14th, consisting of several very small spots. The next picture was taken on the 19th, when one large spot appears near the place where we should look for the group. Clouds prevented photographing again until the 25th, when a large spot was seen near the center of the disk, preceded by a smaller one. On the 26th, no change took place, except that caused by the sun's axial motion. From this time until December 10, on account of clouds and wind, but three pictures were taken, and no spots were observed except a very small group on December 4. December 10, a group of good size appeared, of which five photographs have been taken, showing marked changes during its passage across the disk. The picture of the 10th shows three spots of moderate size just within the eastern limb. On the 12th, the most westerly of these was surrounded by small spots arranged so as to form nearly a complete circle. On the 15th, the group consisted of five distinct spots of good size. On the 16th, no change.

GLUE.

"During the progress of a recent investigation, I observed," says S. Dana Hayes, in the *American Chemist*, "some chemical characters of commercial glue, that I believe have not been previously described.

Analyses of two samples of white glue, of the best grade, yielded the following results:

	"No. 1 extra C." glue.	Frozen glue.
Moisture (loss of weight at 212° Fah)...	16·70	16·28
Gelatin, with a little animal fiber and fats.....	79·85	80·42
Carbonate of lime.....	1·42	1·33
Sulphate of lime.....	0·41	0·34
Phosphate of magnesia.....	0·35	0·31
Alkaline salts.....	0·17	0·12
Silica, oxide of iron, etc.....	0·09	0·08
Oxide of zinc.....	1·01	1·12
Total.....	100·00	100·00

Analyses of ten more samples of frozen and sheet glue, of common grades, and from different makers, showed the proportion of water contained in them to vary from fourteen to eighteen per cent, averaging seventeen per cent. And the proportion of ash or mineral matter varied from three to six per cent, averaging rather less than four per cent. Two of these samples contained about one per cent of white zinc, and two of them contained sulphate of lime.

"Analyses of two samples of commercial gelatin averaged sixteen and a half per cent of water, and 2·56 and 3·11 per cent of ash, respectively. There was no oxide of zinc or sulphate of lime in these gelatins.

The presence of so much water was quite unexpected; and as the quantity is nearly the same in fresh and in seasoned specimens, it is not a make-weight, although steam is very freely used in the rooms where glue is packed by the manufacturers. The carbonate of lime comes from the quick lime used for cleaning and preserving the animal matter, or glue stock, while the sulphate of lime is formed by the addition of small quantities of sulphuric acid during the process of manufacture, to neutralize the lime that is carried forward by the solutions of glue. The oxide of zinc is said to be added to prevent souring, or the acidity caused by decomposition, and it also improves the color of the glue; but it is not very generally used, as these analyses indicate. I have heard of the use of sulphate of zinc, alum, magnesia, etc., by glue-makers, but I did not find any other substance than those named above in these specimens, which represented the article commonly sold and used.

The impure glues, or those containing the most mineral matter, became almost insoluble after they had been broken into small pieces and heated in a hot air bath (copper oven) at 212° Fah., for two or three hours, until they ceased to lose weight; they then soften and become dough-like, but do not dissolve when boiled in water for some time. The purer gelatins were not so much injured, and one specimen, containing only 2·56 per cent of ash, was not materially affected by this thorough drying. The solid sheet glue, while drying in this way, tumefied, and became very porous: the frozen glue did not alter in structure.

The conclusions drawn from these experiments was that the excess of lime combines with the gelatin and, perhaps, with the extraneous animal matters of the glue, at the high temperature, forming a compound like lime soap, as the whole quantity of lime is retained in the insoluble portion left after boiling the dried glue in water. Such an explanation accounts for the difference noticed in the effect of drying upon gelatin and common glue."

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From November 2 to November 26, 1874, inclusive.

ATTACHING TEAPOT HANDLES, ETC.—Tiffany & Co., New York city.
BALE TIE.—W. Cooper, Tyler, Texas.
BARREL.—A. Mason, New York city.
BOOTS AND BOOT MAKING MACHINERY.—F. D. Ballou *et al.*, Boston, Mass.
CARBURETTING AIR.—T. B. Fogarty, Warren, Mass.
CARTRIDGE SHELL.—W. F. Parker, Meriden, Conn.
CHEMICAL TELEGRAPH, ETC.—W. E. Sawyer, Washington, D. C.
DISTILLED WATER.—W. A. Lighthall, Brooklyn, N. Y.
DRAIN PIPES, ETC.—H. Hirsch, New York city.
DRESS PROTECTOR.—C. Murphy, Camden, Me.
FASTENING BUTTONS, ETC.—Z. K. Young, Philadelphia, Pa.
FILE CUTTING MACHINE.—C. Vogel, Fort Lee, N. J.
FISH JOINT.—J. Hampson, Newburgh, N. Y.
GRINDING AND POLISHING MACHINERY.—J. H. Volk, Chicago, Ill.
IRONING MACHINE.—T. S. Wiles, New York city.
LIGHTING GAS.—H. B. Stockwell *et al.*, Brooklyn, N. Y.
LOOM WEFT STOP.—J. J. Switzer, Boston, Mass.
MECHANICAL TOY.—W. A. P. La Grove (of N. Y. city), London, England.
NOSING DEVICE FOR ANIMALS.—W. Crighton, Fall River, Mass.
PIANOFORTE.—A. Steinway, New York city.
PREPARING TEXTILE FIBERS.—H. B. Meech (of N. Y. city), London, Eng.
RATCHET BRACE.—J. W. Evans, New York city.
REAPING AND BUNDLING GRAIN.—E. Horton, Hartford, Conn.
REFRIGERATOR.—J. J. Bate, Brooklyn, N. Y.
ROTARY MOTOR AND PUMP.—J. H. Field, Edgefield, Tenn.
SEWING MACHINE.—Singer Manufacturing Company, New York city.
SHIELD FOR STOVES, ETC.—W. M. Conger, Newark, N. J.
SPINNING MACHINERY.—G. Chatterton, Providence, R. I.
STEAM ENGINE.—T. L. Jones, Natchez, Miss.
STOCKING DARNER.—O. S. Hosmer, Boston, Mass.
STOPPER.—N. Thompson (of Brooklyn, N. Y.), London, England.
STREET LAMP.—E. Parkman (of Madison county, Tenn.), London, England.
TELEGRAPH.—W. E. Sawyer, Washington, D. C.
TRIMMING WALL PAPERS.—H. L. Todd, Corning, N. Y., *et al.*
TYRES ON WHEELS.—E. Mellon, Scranton, Pa.
WATER METER.—F. W. Brooks, New York city.

NEW BOOKS AND PUBLICATIONS.

JOURNAL OF THE CHEMICAL SOCIETY OF LONDON. Price £1. 1s. ($5, gold) a year. London: J. Van Voorst, 1 Paternoster Row.

During the past three or four years, the Chemical Society of London has been engaged in an undertaking which deserves the support and recognition of all who are interested in the progress of physical, and especially chemical, science. For the past few years of its existence, the society published quarterly a report of its proceedings, including the papers on chemical subjects which had been read at the meetings. Afterwards it was found desirable to issue the Journal monthly; and this form it retained till the year 1871, when, with the aid of funds, partly derived from voluntary subscriptions by the Fellows of the Society, partly from a subsidy received from the British Association for the Advancement of Science, the society undertook the task of printing, not only papers read at the meetings in London, but abstracts giving the results of every memoir on chemical or allied physical subjects published either at home or abroad. The monthly Journal of the Chemical Society thus becomes a complete chronicle of the progress of chemistry all over the world. Taking the last number of the journal, we find that the 100 pages of which it consists contain about 150 abstracts of papers taken from seventeen different journals, including the *Annales de Chimie et de Physique*, the *Comptes Rendus* of the French Academy, the *Berichte* of the Berlin Chemical Society, Poggendorff's *Annalen*, and the *Journal fur praktische Chemie*. The student of theoretical chemistry or the manufacturer, the mineralogist, the physiologist, or the scientific agriculturist, may here find a complete and yet concise record of all that has been lately done in the department in which he is specially interested. We trust that such an important undertaking will not be allowed to fall to the ground for want of support.

THE POLARIZATION OF LIGHT. By William Spottiswoode, F.R.S., etc. Price $1. New York: Macmillan & Co., 21 Astor Place.

Mr. William Spottiswoode is the Vice-President of the Royal Society; and, although an amateur, is widely known as a profound and accomplished cientist. The book before us (No. 6 of Messrs. Macmillan's excellent NATURE SERIES) contains the substance of lectures delivered to the work people in the employ of Messrs. Spottiswoode & Co., printers, etc. The branch of optical science herein treated is clearly elucidated, and its great importance in technology and its beauty as a study of natural phenomena demonstrated in forcible and pleasing language.

TABLES FOR THE DETERMINATION OF MINERALS BY THEIR PHYSICAL PROPERTIES, ETC., for the Use of Students in the Field. Translated from the German of Alban Weisbach, by Persifor Frazer, Jr., A.M., etc.

We have here an exceedingly useful and compendious guide for explorers, who frequently have to pronounce on substances *in situ*, where no laboratory is at hand. The eminent author gives many new lights on classification, and his aim has been throughout to render the science of mineralogy as clear and accessible as its complicated nature will permit. The translator's work has been done faithfully and intelligently.

INSECTS OF THE GARDEN, THEIR HABITS, ETC. By A. S. Packard, Jr., Editor of "The American Naturalist," etc. Also (by the same Author) INSECTS OF THE POND AND STREAM. Price 25 cents each. Boston, Mass.: Estes and Lauriat, 143 Washington street.

Two numbers (of twelve) of a most interesting series of handbooks of natural history. We commend them especially to the notice of our young readers, as popular expositions of a most fascinating study.

THE STONE AGE, PAST AND PRESENT. By E. B. Tyler, Author of "Primitive Culture," etc. And "Theory of a Nervous Ether," by Dr. Richardson, F.R.S. Price 25 cents. Boston, Mass.: Estes and Lauriat, 143 Washington street.

The first of these essays is an interesting treatise on the use of stone implements in all ages, and it points out some forcible instances of the survival of the use of such tools to this day. The second paper is a *resume* of the theories on a subject which has been widely and discursively treated, with some original speculation on the supposition, which has long engaged the attention of the eminent author.

REGISTER OF RURAL AFFAIRS. Price 30 cents. Albany, N. Y.: Luther Tucker & Son.

Messrs. Luther Tucker & Son, Publishers of the Albany, N. Y., CULTIVATOR, have issued their illustrated Annual for 1875 in a very attractive form. It contains a large number of engravings of interest and use to agriculturists, and is full of practical suggestions and directions of importance to horticulturists and fancy gardeners.

THE INTERNATIONAL REVIEW. $5. Six times a year. New York: A. S. Barnes & Co.

The number for January and February contains several valuable articles. Dr. McCosh, President of Princeton College, reviews the late utterances of Professor Tyndall, about the potency of matter, and shows the weak points of his reasoning. Professor Vogel gives an article on Baron Liebig. Professor Hart discusses the proposed Centennial Exhibition and that of Vienna.

THE CHEMIST'S AND DRUGGIST'S DIARY FOR 1875.

A useful and convenient form of diary, published by the proprietors of our esteemed contemporary, the CHEMIST AND DRUGGIST, London, England.

ANNUAL REPORT OF THE TREASURER OF THE UNITED STATES TO THE SECRETARY OF THE TREASURY, for the Fiscal Year ended June 30, 1874. Washington, D. C.: Government Printing Office.

MR. JAMES VICK, one of the largest seed dealers of Rochester, N. Y. has just published the first number of his FLORAL GUIDE for 1875. This is a good sized magazine, beautifully illustrated, and containing descriptions of the best flowers and vegetables, with valuable directions for culture. It is issued quarterly in English and German, and sent to any person for the nominal price of twenty-five cents a year.

THE DOUBLE CENTURY CALENDAR AND SILICATE NOTE BOOK is the title of a pocket volume forwarded to us by Mr. C. W. Youngren of Amboy, Ill. The silicate part is useful—the balance obscures an advertisement of a well known watch concern.

DECISIONS OF THE COURTS.

United States Circuit Court.—District of Massachusetts.

PATENT EGG BEATER.—EDWIN P. MONROE *vs.* THE DOVER STAMPING COMPANY.

[In equity—September 3, 1874.]

Shepley, J.:

Complainant alleges that defendants infringe the invention secured to him by letters patent, reissue No. 1,062, dated October 16, 1860, for a new and improved egg beater. Defendants, under license from the patentees, were making and selling egg beaters under and in conformity to letters patent of the United States granted to Turner Williams and E. D. Goodrich, assignees of Turner Williams, dated May 31, 1870, and numbered 103,811.

The beater described in complainant's patent consists of a frame, to be clamped to a table or other support, with two concentric beaters, which are, by suitable gearing, revolved in opposite directions. The vessel containing the eggs to be beaten is held up to the beaters, which project downward from the frame, so that the beaters will be immersed in the matters to be beaten. By turning the crank the beaters are revolved concentrically in opposite directions. In the Monroe patent the first claim is for, "in combination with a rotary egg beater, an arm having at one end bearings for the journals to rotate in, and at the other a clamping device for the purpose of securing the beater to the table with its shaft or bearing in a vertical line, as set forth." It is not contended that defendants infringe this claim. The second claim is for "the beaters revolved in opposite directions by suitable mechanism, substantially as set forth." The Monroe beaters revolve in opposite directions, and the beaters in the Turner Williams patent also revolve in opposite directions. Here their resemblance begins and ends. The Monroe beaters revolve concentrically. The axes of the beaters in the Williams machine are at some distance apart, and the orbits described by the revolution of the blades of the beaters intersect each other. The currents produced in the matter to be beaten are entirely different. In the Monroe beater the fluid material tends to arrange itself mainly in two concentric layers, which are carried around in opposite directions by the beaters, the centrifugal force tending to accumulate the material around the circumference of the vessel. In defendant's beater this action does not take place, for the reason that the orbits of the blades intersect at two points in their circumference. After the blade of one beater has passed through the material, another beater, moving in an opposite direction, passes through the same material, obliterating the track made by the other, and so on alternately. There are other obvious and important differences in the mode of operation of the beaters, which render it too clear to admit of any doubt that the invention described in the Turner Williams patent is not an infringement of the patent to Monroe.

Bill dismissed.

Held by the court;

Making and selling egg beaters having two beaters rotating on axles separate and apart from each other, is no infringement of a patent for such an implement having two beaters rotating on the same axis, although in both cases the beaters revolve in opposite directions.

[James B. Robb, counsel for complainant.
Thomas W. Clarke, counsel for defendants]

United States Circuit Court.—District of New Jersey.

PATENT MITER MACHINE.—GEORGE W. LA BAW *et al.*, COMPLAINANTS, AND WILLIAM HAWKINS *et al.*, DEFENDANTS.

[In equity.—Before Nixon, Judge.]

This is a suit for alleged infringement of letters patent No. 3,445, for "Improvement in miter machines," reissued to George W. La Baw, May 18, 1869, and extended by the Commissioner of Patents for seven years from May 29, 1869.

The defendants filed a joint and several answer, alleging, among other things, that the surrender made by the complainant of his original patent was not for a good and sufficient cause, and that the reissue was for a different invention, denying the infringement and setting up prior public use. They admit that they have constructed and sold miter machines containing knives or cutters in combination with mechanism for operating the same for cutting miters, under the authority of letters patent granted to one Stephen W. Hall, August 17, 1858, but deny that the said Hall machine infringes upon the invention described in the bill of complaint.

It is the judgment of the court that the defendants have infringed the second claim of complainant's reissue, and there must be a decree for an injunction and an account.

Held that:

Whenever a patent is reissued or extended, the presumption is that it is for the same invention, and the action of the Commissioner is conclusive against a charge of fraud in obtaining the extension or the reissue, as well as all other objections, unless it appears upon the face of the papers that the new patent is not for the same invention as the original.

The testimony of witnesses of whose names no notice was given to the complainants is admissible to show the state of the art; but will receive no consideration upon the question whether there had been a prior knowledge and use of the invention.

It will require strong evidence to overcome the presumption that a patented machine is substantially different from one patented before, which arises from the Commissioner's having not only issued the second patent with the knowledge of the other, but having afterward reissued it and extended it.

The experts produced by the parties having disagreed whether the machine covered by the patent in suit was anticipated by one previously patented, the court examined the question itself, and held that it was not.

A patent will not be set aside upon the mere testimony of a single witness that many years ago he saw a machine like the one described; it must be regarded at most as an abandoned experiment, no second machine having been known.

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Althou nd obta hine wi — man may make valuable improvements upon a patented machine ents for them, he cannot use the elements of the original ma- infringing on the first patent.

[C. A. Durgin and J. Marshall, for complainants. Runyon & Leonard, for defendants.]

LOOKING GLASS PATENT.—THE FLORENCE MANUFACTURING COMPANY *vs.* THE BOSTON DIATITE COMPANY.

[In equity.—May Term, 1874, to wit: September 3, 1874.]

Shepley, J.:

This suit is founded on the letters patent granted to Dudley & Clark, assignees of W. N. Dudley, July 29, 1869, for an improved hand mirror. The mirror was constructed by first using a base piece of wood or other suitable material, preferably of similar contour to the glass designed to be mounted on it, and elongated at one end, with a strip of metal or other stout material at its back to form a stiffener for the handle of the mirror. The base piece, with its handle extension or stiffener, is laid, face downward, on a mold, and a composition of any suitable plastic material, in sufficient quantity to cover the back and extend beyond the edges of the base piece and surround the handle stiffener, is applied, when an upper mold of suitable configuration, and with its interior embellished with any ornamental devices, is pressed down on the plastic composition, thus making a smooth finished ornamental outer back and handle. The advantages claimed for his new manufacture by the patentee are that the handle and back of the mirror are "smooth finished, and may be highly ornamental, impervious to damp, exempt from warping, with its consequent liability of fracturing the glass, and preservative of the wooden or other base piece, which may be of a cheap and rough construction; and that by its end extension, with strengthening strip at the back, gives not only a general stability to the whole article, but especially stiffens the handle at its junction with the back or body, where it is naturally weakest or most liable to break."

The claim is: As a new article of manufacture, a hand or portable toilet mirror, constructed, substantially as described, of a base piece B, with its handle extension piece or stiffener C, glass A, and outer back or handle D, made of any suitable composition or cement, substantially as specified.

Respondent made hand mirrors, in other respects like those described in the Dudley patent, but having no "wooden or other base piece of suitable material" behind the "glass designed to be mounted on it," and having no extension from such base piece into the handle. In the smallest and weakest part of the handle two nails of iron were embedded in the plastic compositions, which formed the entire frame and handle of the mirror, but they did not extend behind the mirror, or form any base or support for the glass or the frame behind or around it.

This is clearly no infringement of the Dudley patent. The practice of molding a plastic material around a skeleton, or partial skeleton, of a material of greater rigidity is as old as anything known in the arts, was practised by the Assyrians in molding bronze, and has been in common use to the present day. Hand mirrors date back to an equally remote antiquity. Hand mirror frames, molded from a plastic composition of *papier mache* and other plastic compounds, were well known before the date of Dudley's invention. Frames for pictures and photographs of a plastic composition of shellac and other substances, molded and ornamented, were well known and described in Merrick's patent of December 16, 1868, for his new composition of matter. The patentable matter in Dudley's patent must, therefore, be found, if found anywhere, in his new composition of a base piece, with its extension or handle stiffener, with the other elements in his combination. Without such combination there would have been no new article of manufacture. It is not every new article put upon sale in the market which is a new article of manufacture. If one were to substitute a Claude Lorraine glass for the plate with its stiffened back in the Dudley hand mirror, it would be a new article of commerce, but not a new manufacture.

In the case of Clark *vs.* Scott (2 *Official Gazette*, 4), Judge Blatchford held that hand mirrors made of cement, applied in a plastic state and afterward hardened, and having embedded in the cement, and concealed from view, two flat wires or strengtheners, made of metal, which run from the body of the mirror part through the neck and into the handle, and which serve to strengthen and stiffen the article, particularly at the junction of the handle with the body, were infringements of the Dudley patent. But this was upon the ground that he found in those mirrors the base piece, the handle extension piece or stiffener, the glass and outer back and handle of cement. He says "the defendant's wires act as a base piece or support for the glass, and the wires extend through the neck and in the handle as stiffeners." But in defendant's mirrors there is no base piece or support for the glass, and no substitute or equivalent therefor. He makes a hand mirror with a molded frame of plastic compound, and he reenforces or strengthens the handle with metallic rods. There was nothing new in this before the date of the Dudley patent.

Held that:

In a hand mirror containing a wooden back with an extension for a handle strengthened by metal rods, the whole being covered with a composition, to which form is given while plastic in a mold, the novelty consists in the introduction of the wooden back and strengthened handle.

A patent for such a mirror is not infringed by one in which the back and handle are formed entirely of composition, though the handle is strengthened at its weakest part by nails embedded in it.

Clark *vs.* Scott (2 *Official Gazette*, 4), commented on and explained.

Bill dismissed.

[E. W. Bond, for complainant. T. W. Clarke, for defendant].

REPEAL OF PATENTS.---OPINION OF THE ATTORNEY GENERAL.

The following letter of the Attorney General is of great interest to patentees and the legal profession, as it contains an announcement of the principles which will control the Government in the matter of its joinder in suits to repeal patents:

DEPARTMENT OF JUSTICE,
Washington, D. C., November 19, 1874.

SIR: On the 6th instant an application was made to me by Messrs. Curtis and Corwine for leave to use my name in a suit upon the relation of George R. Fearing, Esq., to vacate a patent issued to B. F. Sturdevant, for a coil or ribbon of blank wood for the use of pegging machines. It was alleged as a ground for this application that there was a want of novelty in the said ribbon or coil. Accompanying this application were several affidavits to the effect that Sturdevant had recently raised the price of said blanks from twelve and a half to twenty cents each, and that a similar article was offered in the market for eight cents.

I was induced to think, upon the showing then made, that the leave asked for should be granted, and you were accordingly instructed to take the necessary steps for the commencement of the suit. Since then, application has been made to me by Messrs. Curtis & Corwine to amend the bill, and at the same time Mr. Sturdevant, with his counsel, Mr. Roberts, and others, claiming to represent the manufacturers of boots and shoes, asked to have the order made for the use of my name in said suit rescinded.

It is somewhat difficult to determine in what cases the Attorney General should allow his name to be used to set aside a patent as contemplated by the Supreme Court in the case of Mowry *vs.* Whitney, 14 Wall, 434. "The ancient mode," says the court in that case, "of doing this in the English courts was by *scire facias*, and three classes of cases are laid down in which this may be done.

1. When the king, by his letters patent, has, by different patents, granted the same thing to several persons, the first patentee shall have a *scire facias* to repeal the second.
2. When the king has granted a thing by false suggestion he may, by *scire facias*, repeal his own grant.
3. When he has granted that which by law he cannot grant, he, *jure regis* and for the advancement of justice and right, may have a *scire facias* to repeal his own letters patent."

And the court further remarks that "If an individual finds himself injured, either specially or as a part of the general public, it is no hardship to require him to satisfy the Attorney General that the case is one in which the Government ought to interfere, either directly by instituting the suit, or indirectly by authorizing the use of its name, by which the Attorney General would retain such control of the matter as would enable him to prevent oppression and abuse in the exercise of the right to prosecute such a suit."

When Sturdevant's patent was issued, the question as to the novelty of the invention claimed by him was expressly decided by the Commissioner of Patents, and upon the reissue of the patent another decision of the same kind was made. I am now called upon by the relators, upon the allegation that there was no novelty in said invention, to proceed in the courts for the purpose of reversing these decisions.

To allow this would be practically to give an unsuccessful party objecting to a patent the right to appeal to the courts, and would seem also to put one department in the attitude of attacking the acts of another department of the Government. Whenever it appears that the Commissioner of Patents has become satisfied that, through fraud or mistake, a patent has been improperly or illegally issued, the Attorney General, as a general rule, in my opinion, ought, upon the relation of "an individual who finds himself injured thereby," to allow a suit to be brought on behalf of the Government to set aside such a patent. I do not mean to say, however, that the views or wishes of the Commissioner should be conclusive upon the Attorney General, but his action in such cases ought to look as well to the rights of the patentee as to the interests of those who seek its cancellation.

Taking a case like the one before me, in which the question is as to the novelty of the alleged invention, I have determined that where the Commissioner withholds his consent to a suit in the name of the Attorney General, to vacate a patent issued by him, such suit ought not to be brought until the validity of the patent in question has been denied or at least gravely doubted in a judicial proceeding between private parties, as where the patentee sues some infringer of his alleged patent. Exceptions to this rule may be admitted where persons, alleging a want of novelty in a patent, infringe it, and the patentee delays suit with a view of allowing a large claim for damages to accrue, or where, with doubts as to the validity of his patent, there are special circumstances of injustice or oppression on the part of the patentee. But to preserve something like consistency in the action of the different branches of the executive department of the Government, and to afford adequate protection to the discoveries and labors of inventors, it is necessary, in general, that the rule above stated should be observed. If the invalidity of a patent appears in a litigation about it between private parties, the Attorney General, upon a proper application, ought to interfere to prevent the patentee from harassing other persons with suits for the use of his pretended invention.

When fraud is alleged as a ground of suit in the name of the Attorney General, to repeal a patent, nothing more than to satisfy him of the existence of the fraud is necessary to the application, as such a case cannot go upon the ground that the facts disclosed to the Attorney General were not presented to or passed upon by the Commissioner of Patents.

Mr. Sturdevant has given satisfactory reasons for advancing the price of his peg wood blanks, and that it was by an arrangement with the manufacturers of boots and shoes, and for their benefit; and I am further satisfied that the public interests do not require me to take any steps to vacate his patent. You will, therefore, withdraw the bill filed, and decline any further use of my name in this matter.

Very respectfully,
[Signed] GEORGE H. WILLIAMS,
Attorney General.

George P. Sanger, Esq., U. S. Attorney, Boston, Mass.

Recent American and Foreign Patents.

Machine for Rolling Blanks for Nut Bars.

George Johnson, Haverstraw, New York.—This invention consists of a revolving clearer having notches in its periphery, in combination with a pair of rolls for rolling notched bars. The notches of the clearer correspond to the notches in the rolls for forming the hexagonal nuts, so as to mesh with the notches in the soft, hot iron as it is received and discharged by the clearer.

Improved Water Elevator.

Henry M. Sweet, East Haddam, Conn.—The shaft passes through a box flange which is attached to the brake lever. This box flange is made to slide in a slot of a curb sufficiently to throw a pinion out of gear with a wheel. The pinion is thrown out of gear, at the same time that the brake is applied, by manipulating a lever, by means of which the bucket may be stopped, when full of water, at any desired point.

Improved Garter.

Samuel Chard, Mianus, Conn.—This consists of an outside spring band and an inside adjusting band, severed at one point, and connected together. The inner band will be made a little less in circumference than the limb which it is designed to clasp. It is placed over the top of the stocking, and exerts, through the spring band, a gentle pressure sufficient to hold the stocking securely to the leg.

Securing Handles to Burial Caskets.

William S. Wood, Newtown, N. Y.—An ear plate extends from one end to the other of the handle, and is of some ornamental design. A stay plate is placed on the inside of the casket and is secured by screws and nut rivets having square shanks, which pass through square holes in the stay plate, and through the side of the case, and are riveted thereto to keep them in place before the handles are attached. The stay plate extends down through the case to near the bottom with a rib on its outer side, and has a tendency to stiffen the side of the case and keep it in shape when lifting upon the handles.

Imporved Voltaic Battery.

Dr. Robert Arthur, Baltimore, Md.—This invention relates particularly to an improvement in the mechanical construction of the batteries known as the Bunsen or carbon and the Grove, although it is applicable to other forms. The invention is the result of difficulties encountered in the employment of these and other well known batteries for running a small electro-magnetic engine, and for operating an electro-magnetic mallet for condensing gold in the operation of filling teeth. The battery is composed of the following elements, namely: An outer jaw or cylinder with lower end closed, having a groove or depression in its bottom containing mercury; an inner perforated cylinder having one or more tubes attached; and a carbon plate provided at the upper end with a platinum tube, and fragments of zinc in suitable quantity, the latter being placed in the annular space between the outer jar and inner perforated cylinder.

Improved Mooring Attachment for Buoys.

Henry Brown, Charleston, N. C.—The object of this invention is to provide a means of replacing the worn out loops of buoy bottoms and ballast bulls, without the expense, time, and trouble usually involved in the repair of the same. It consists in making the bottom plate of the buoy with a pocket, which receives a detachable mooring link, to be fastened therein by a keyed bolt. It also consists in casting the ballast bull with two holes, which intersect each other at right angles at the center, one of which said holes receives the tapering shanks of two loops, and the other a bolt which passes through the said shanks and locks them.

Improved Water Piston for Hydraulic Presses.

John F. Taylor, Charleston, S. C.—This invention consists in a hydraulic piston formed of the usual packing rings, so united with a cut and an elastic ring that a very durable and efficient piston is obtained, while the cost thereof is comparatively small.

Improved Car Coupling.

Ezra N. Gifford, Cleveland, O.—This invention relates to certain improvements in car couplings, and it consists in the peculiar construction of a slot or recess in the side of the coupling catch, in which rests the end of a cross bolt, by means of the peculiar conformation of which said recess the said catch is controlled in its motion and position, and the danger of its loss obviated. It consists also in the inclined shape of the shoulder upon the front of the coupling catch; and the mode of locking the short cross bolt by embedding its bent end in a recess in the drawbar, whereby the said bolt is protected from incidental knocks, is always kept in place, and is easily detachable. The invention further consists in the peculiar construction of the drawbar in combination with the coupling catch and bolt.

Improved Velocipede for Picking Cotton.

Charles and George E. Hess, Huntsville, Ala.—This invention relates to means whereby a person may be enabled conveniently and with the least possible labor to pick cotton from the pod or stalk, and place the same within a bag, the said picker and his bag being supported relatively to each other during the whole operation, while the bag is readily conveyed along from point to point without manipulation.

Improved Gas Cooking Apparatus.

Thomas Peacock, Wood Green, Eng., and John C. Peacock, Finsbury Park Road, Eng.—This invention consists in economizing the heat derived from a combustion of gas by preventing the walls, top, and bottom of stove from radiating the heat generated within the oven, and it also consists in ventilating the oven by an exact supply of air, while the products of combustion are drawn off at the lowest possible level.

Improved Bracket for Dentist's Chair.

George W. Gray, Albany, Oregon.—A slotted plate is attached to a metal plate which is attached to the chair by means of a pivot joint, so that it can be inclined in any position, carrying with it a sleeve in which slides an upright tube. The last is held as desired by a set screw. A T joint is attached to the top of the upright through which passes a sleeve which slides on a feather. On the end of the arm which slides through the sleeve is an upright tube, on the upper end of which is a ball and socket joint. The ball is clamped in the socket by a set screw. A table of any form is arranged on the arms, which extend from the stem of the ball. On this table are arranged any instruments or materials used in filling and excavating teeth. Water cups are attached by means of sliding rings. When the patient is seated, the table is adjusted by means of the various mechanisms described, to bring the instruments and materials into convenient position for use.

Improved Button Boot.

Edward F. Wells, New York city.—The lower portion of the overlapping flap of a button shoe is made in one piece with the quarter. A flap piece constitutes the upper part, which is sewn to the main portion, the slit extending about half way down the latter. The seam, at the place where it bears inside against the leg, is not so liable to be hurtful as an inside seam along the instep.

Improved Rotary Harrow.

William J. Murphy and William H. Cock, Murfreesborough, Tenn.—There are two rollers, a foot in diameter, into which are screwed knives. To a cross bar is bolted another set of knives, so arranged that their paths may be midway between the paths of the knives of the rollers. There is besides a roller which is designed to roll and smooth the ground in the rear of the harrow.

Improved Wheel Plow.

John B. Herman, Blair, Neb.—The plow beam is connected to the bar by a universal joint, which gives it a free vertical and lateral movement, so as to allow the plow to be laterally adjusted to cut a deeper or a shallower furrow, or a wider or narrower furrow, as may be desired. There are besides novel devices which enable the plow to be readily adjusted to run deeper or shallower in the ground, and others by which the caster wheel may be readily adjusted to take the downward pressure of the plow, and thus decrease the friction and enable it to be drawn by less power, and mechanism which permits the plow to be readily lowered to and raised from the ground when desired, and holds it securely in place when suspended.

Improved Sheaf Dropper for Harvesters.

Perry G. Nichols and William O. Nichols, Cresco, Iowa.—The table is pivoted to the frame for tilting. It has an arm extending below the pivot at one end, to which a cord is fastened, which is suitably connected with a bell crank. The last communicates with a foot treadle in front of the driver's seat, so that by a downward movement of the foot treadle a catch will be pulled back to unfasten the table, and the table will be tilted to dump the sheaves. The table will then be turned back by gravity, the weight of the next sheaf put on by the binders, and it will be fastened by a catch and spring. The catch is so arranged relatively to the binder's table that the binder next to it can reach it readily to unfasten it by hand.

Improved Peg Box for Pegging Machine.

George H. Davis, Oxford, Mass.—This invention consists of a peg box with two feed channels for stock, to make pegs of two sizes, and feed mechanism and shifting apparatus, adapted for use in connection with the pegging machine patented by C. Varney, and so arranged that the operator can shift the feed mechanism at will without interrupting the operation of the machine, to use pegs of different sizes in different parts of the work. The invention also consists of certain improvements in connection with the cutter, and an improved form of the peg driver.

Improved Compound Metal Working Machine.

George L. Jones, Vanville, Wis.—This invention relates to improvements in the compound metal working machine patented by the same inventor, under date of September 2, 1873. The punching mechanism, substantially such as previously employed, operates a supplementary punch, so that bands, tyres, etc., may be punched at certain points with large holes, and at others with small ones at the same time.

Improved Whiffletree Tug Fastener.

James L. Graff, Petrolia, Pa.—Instead of boring the whiffletrees longitudinally to receive rods, cylindrical metal caps are applied to each end of the whiffletree. A sliding rod, having a knob at one end and a plate at the other, is formed at a right angle to each cap. A short pin projects from the center of the disk in a plane parallel with the sliding rod. A bar slides in a socket formed on the rear side of the cap, while the plate projects interiorly of the socket and a pin projects through the loop formed on the end of the socket. A coiled spring is placed in the cap between the end of the whiffletree and the plate. The ends of the traces are inserted in the loops on the cap, the pins having been first drawn back into the sockets by pressure applied to the knobs, and there secured. To release the traces, the bars are drawn toward each other by cords, which are joined to a ring between centrally arranged pulleys.

Improved Soap Bubble Toy.

William A. Harwood, Brooklyn, N. Y.—This is a little tin cup with another small cup attachment on the bottom, forming an inclosed chamber, in which is a hollow cone with a hole in the top. A small tube like a pipe stem enters the chamber at the top, and there is a passage from the cup into the chamber. There is also a small hole through the bottom of the chamber containing the cone, and around the outer edge of the bottom of this chamber is a flange projecting downward a short distance. The pipe blows along the surface of the water, and carries small quantities along with it down through the exit passage to form the bubble.

Improved Saw Gummer and Sharpener.

Henry Baughman, Dorn's Gold Mine, S. C.—This invention has for its object to improve the construction of the saw gummer for which letters patent were granted to the same inventor, February 18, 1873, and December 9, 1873. To an upright frame is bolted a block, and a support for the block, against which the straight saw is clamped to be operated upon. The inner end of this block may be inclined to one side and the other, to give a bevel to the saw teeth. The clamp, by which the saw is held, has a rabbet on its inner side for the back edge of the saw to rest upon, and is so constructed that, when one tooth is gummed and the clamp allowed to drop down, the inclination of its slots will carry forward the clamp, and with it the saw. As the clamp is again raised by a lever, a tooth of the saw will catch upon a stop attached to the block, by which the saw will be held, so that it cannot be carried back by the backward movement of the clamp, thus bringing the next tooth into position to be operated upon by the gumming wheel. Another new feature is the provision of an orifice in the block for the escape of filings.

Improved Heat Radiator.

Owin Marrin, Brooklyn, N. Y.—This invention consists in providing the inner cone of the radiator with flexible plates projecting from its base, and arranged at suitable distances apart to regulate the size of the openings, through which the heated air, gases, and other products of combustion ascend in the flue.

Improved Saw Tooth Swage.

Alonzo G. Rouse, Jacksonville, Fla.—In using this swage, the tooth of the saw is first inserted between projections, its edge projecting into a recess. Blows with a hammer upon the stock will cause the said projections to form small transverse grooves in the upper and lower sides of the tooth. The swage is then removed and adjusted to bring the edge of the tooth between another projection and the inclined end of a die. Hammering upon the end of the stock will thus bring the edge of the tooth to the proper form, obliterating the grooves and finishing the edge or point of the tooth.

Improved Polishing Machine.

William S. Wood, Newtown, N. Y.—In this device motion is effected by a rotary spindle with a chuck plate, to which is attached a spring pivot carrying a box or holder for the grinding substance, in such a manner that the pressure and stroke or motion are entirely at the command of the operator.

Improved Brick Mold.

John Treadway, Haverstraw, N. Y.—This invention consists of a removable key or wedge block placed beneath the reciprocating plunger of the machine and above the platform, whereby the amount of pressure on the brick is raised according to the quantity or condition of clay in the mold.

Improved Soap Frame.

John H. Keller, New Orleans, La.—This is a soap frame for forming soap blocks, constructed of iron side walls strengthened by longitudinal re-enforcing wooden bars, and of wooden end walls bound by the vertical flanges of the side walls, the whole being firmly clamped together and to the bottom part.

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Answers to Correspondents

J. E. S. will find a description of mica on p. 88, vol. 25.—J. J.'s proposition as to an astronomical problem is utterly unintelligible.—W. P. will find directions for black enamel leather on p. 122, vol. 27.—E. S. can bleach moss by using a preparation described on p. 91, vol. 28.—H. W. M. and W. J. will find a description of the art of molding or modeling on p. 58, vol. 24.—C. C. will find a recipe for solder for gun barrels and other iron and steel work on p. 353, vol. 27.—J. V. will find directions for japanning iron work on p. 208, vol. 26. Bronzing is described on p. 283, vol. 31.—J. J. McG. will find directions for cleaning brass and nickel plating on p. 370, vol. 26.—F. E. W. will find a recipe for indelible ink on p. 112, vol. 27. Japanning on iron is described on p. 122, vol. 27.—W. L. A. will find an account of the canal boat award on p. 81, vol. 30.—W. C. R. can keep the rust from his plowshares by following the directions on p. 283, vol. 31.—J. W. P. will find a rule for proportioning cone pulleys on p. 180, vol. 26.—J. H. D. will find explicit directions for constructing a cheap telescope on p. 186, vol. 30.—W. P. M. will find full directions for treating sumac on p. 363, vol. 31.—B. B. B. will find a formula for silver plating without a battery on p. 299, vol. 31. Galvanizing wrought iron is described on p. 346, vol. 31.—W. J. can temper his brace bits to a straw color by the method given on p. 21, vol. 31.—W. H. H. will find directions for making a good soft solder on p. 185, vol. 27.—E. E. H. should apply to the master mechanic of a railroad.—B. F. G. will find directions for nickel plating steel on p. 43, vol. 31. Polishing brass is described on p. 102, vol. 25.—A. S. G. will find full directions for etching on glass on p. 409, vol. 31.—J. E. will find rules for calculating the proportions of gear wheels on p. 330, vol. 24.—E. B. W. will find directions for mending rubber boots on p. 208, vol. 30.—J. C. H. will find full directions for stuffing and mounting animals on p. 250, vol. 30.—H. D. P. will find a recipe for scarlet ink on p. 200, vol. 30.—C. T. will find full directions for washing flannel and other woolen fabrics on p. 267, vol. 30.—H. F. H. will find instructions for gilding on walnut on p. 90, vol. 30.—E. B. M. will find directions for turning iron on pp. 76, 122, vol. 30.—M. B. can galvanize iron wares by the process described on p. 346, vol. 31.—D. H. M. will find a description of a simple and excellent filter on p. 251, vol. 31.—J. H. B. will find instructions for gilding on china and glass on p. 41, vol. 27.—J. J. and many others will find that the anti-snoring device is illustrated on p. 34, vol. 24.—F. W. will find a recipe for the logwood and copperas dye on p. 331, vol. 31.—A. G. S. and D. M. will find a formula for harness blacking on p. 218, vol. 28.—H. C. will find ample information on measurement of engine power on p. 16, vol. 29, and on indicating engines on p. 64, vol. 30.

(1) G. W. says: 1. I have thought of making a cistern of brick inside of a series of grate and stove flues, running from the cellar to the top of a dwelling. Can I make it with iron hoops, strong enough to be safe when filled with water to a hight of 25 feet, using water lime in laying the brick and plastering inside? My object is to prevent freezing and to economize in room and brick by combining the cistern wall with the inside walls of the flues, thus making a reservoir for water by letting it run from the roof and thence to any part of the house, through pipes, properly arranged in the walls and secure against frost. A. By making the interior wall of the cistern of sufficient thickness to resist the pressure, such a construction is possible. But it is objectionable in two respects: First, the water at the bottom will be so low as to be capable of being supplied only to the lower part of the house; and secondly, the column of water will be so extended when full as to cause an undue pressure at the bottom. Both of these objections will be overcome by adopting the usual tank at the upper part of the house, and the danger of freezing in such case is less than is generally supposed. 2. Can a four inch wall of brick be built around the outside of a wooden frame building, instead of siding the house with wood, anchoring the word to the frame occasionally? The object is to save painting; it would also be safer from outside exposure to fire. A. We consider such a construction very impracticable, as the unequal settlement of the diverse materials would cause them to separate, and thus in a very short time cause the house to have the appearance of a ruin. The expense of making the wall entirely of brick, moreover, would not be much greater.

(2) W. L. says: In order to ventilate and carry off a portion of surplus heat in a small conservatory or greenhouse, I put a round ventilator in the ceiling, 18 inches in diameter, carrying a sheet iron tube of the same size through and about four feet above the roof, with a cap. The room is heated by a double tier of hot water pipes. Contrary to my expectations, instead of having an upward draft, the cold air blows down the shaft during a windy day, and on still days is sluggish and inert, affording no satisfactory ventilation. How can I obviate the difficulty? A. You do not say whether you have an opening to the outside air near the floor. If you have no such opening, we should suggest one as a remedy.

(3) A. C. R. says: No. 1 asserts that houses with cellars are healthier than those built without them; but No. 2 says the contrary, and that a house built on solid foundation without cellar is not likely to be affected by disease arising from impure air as easily as the house built on a cellar. Which is right? A. There have been so very few houses built without cellars that this question cannot be answered experimentally. If you fill a vessel with sand and then pour water into it so as to allow the latter to rise to within a short distance of the surface, you have a good representation of the way the water lies in the earth; but sometimes it is at one hight and sometimes at another. In some localities it lies deeper than in others. It this city, at one section, water can always be found within 6 feet of the surface; on the other hand, at Passaic Bridge, a well had to be sunk 60 feet before water could be obtained. It can, therefore, easily be inferred that the healthfulness of a house, having a cellar, will depend upon the nature of the soil in this respect, for it would make very little difference as to dampness, to a house at Passaic Bridge, whether it had a cellar or not. But answering generally as to cellars, if the first floor is set high up from the ground and is well ventilated beneath, the probabilities of health are in favor of the house that has no cellar.

(4) J. G. R. says: 1. In consequence of a too severe strain on our engine, the foundation wall is shaken. Can we remedy it by passing Rosendale cement (sufficiently diluted) into the cracks, or would it be better to bind it with bolts and plates? A. We think it would be well both to bind the foundation, and to fill up the cracks. 2. We have another foundation in which mine water has eaten the keys from the lower bolt ends, thereby causing the bolts to turn when the nuts are turned. Can I tighten the bolts in the masonry by pouring in a solution of sal ammoniac mixed with fine iron filings? A. We scarcely think you can use the sal ammoniac and iron filings, unless there is a good chance to make a driven joint. Melted sulphur will answer very well, if you can prevent it from running out of the bottom of the openings as it is poured in.

(5) E. M. asks: 1. What part of a horse power will it take to run a sewing machine? A. From 1-30 to 1-20. 2. What bore of cylinder would be the most economical to run 10 family machines? A. From 2 to 2½ inches will answer very well. 3. Will a ⅝ supply pipe supply steam enough for a 2½ inches cylinder? A. In general, yes.

(6) R. L. H. says: What is the difference in temperature, or relative heat, of the oxyhydrogen blowpipe and the common blowpipe? A. The temperature of the common mouth blowpipe at its hottest point is about 2,000° Fah. That of the oxyhydrogen blowpipe has never, we believe, been accurately determined.

(7) F. W. asks: 1. How can I cover muslin with a thin coat of gum? A. You do not state what kind of gum. 2. How can I color it black inside and a light yellow outside? A. We know of no better method than that of coating it with size, and then applying the desired pigment with a brush.

How can I clean dogskin gloves? A. We can recommend benzine for this purpose.

(8) J. G. C. says: 1. What is the relation of the magnifying lenses to the condensing lenses with regard to focus in the magic lantern? A. The relation depends upon the amount to which it is desired to magnify the objects placed before the condensers. To give the relation in any particular case, it is necessary to know the character of the lenses employed. 2. What is the use of the Lieberkuhn? A. The Lieberkuhn consists in placing the small lens in the center of a highly polished concave speculum of silver, by which means a strong light is reflected upon the upper surface of an object, which is thus examined with great ease.

(9) A. D. P. asks: What is the best method of separating gold and lead? A. By means of the cupel. There is no means easier or cheaper.

There is a rock in North Carolina called the cotton stone. What is it? A. Send us a specimen.

(10) C. A. asks: What kind of furnace or retort is used in making lampblack? A. The burning of the tarry and pitchy combustibles is carried on in any suitable furnace. The smoke is conducted through long horizontal flues terminating in chambers hung with sacking, upon which the lampblack is deposited.

(11) S. P. B. asks: What kind of steel are files made of? A. Generally from cemented steel, rolled or hammered. 2. What is the difference between cast and spring steel? A. The first is cemented steel, melted, cast into ingots, and rolled into bars. Spring steel is produced, according to Bauerman, by heating blistered steel to an orange red heat, and drawing down in size by hammering or rolling.

(12) T. A. C. says, in reference to lining shafting (p. 340, vol. 31): Suppose T. F.'s shafting is already up, and has got out of true: do not put him to the trouble of removing it from the bearings, but tell him to stretch a line parallel with the shafting, that is, equidistant from the ends, as close to the shafting and as near level with its center as the surroundings will permit. True it laterally by the line and then level it up. A. This is a good method for an experienced workman, but the other is best adapted for general use.

(13) I. G. H. says: To run a saw mill, we have an engine 14×36 inches stroke, with an 8 feet driving wheel, belting to a pulley on the main countershaft only, 3½ feet diameter, surface 15 inches. This pulley is so small (in order to give the necessary speed) that the belt will slip. Can we, by putting in another countershaft, improve the mill by belting from the engine, and then to the present shaft, thereby giving an opportunity to increase the pulleys to a size that will prevent slip? The engine is said to be 60 horse power. It is argued that this extra shaft would take so much more power that the engine would not drive the mill. Can you tell us about how much power it would consume to drive this extra countershaft, it being about 8 feet long? A. The change suggested would be a decided improvement; and instead of a loss, more of the power of the engine would be utilized than at present.

(14) E. C. D. Jr. asks: How can I test soda ash? A. The test is to find how many measures of diluted acid are required to destroy the alkaline reaction of and to neutralize 100 grains of a specimen of soda salt. The acid is measured in the alkalimeter, which is a straight glass tube, or very narrow jar, with a lip, about ⅝ of an inch in width and 14 or 15 inches in hight, generally mounted upon a foot, and capable of containing at least 1,000 grains of water. It is graduated into 100 parts, each of which holds 10 grains of water. To form the test acid, 4 ozs. oil of vitriol are diluted with 20 ozs. of water, or larger quantities of acid and water are mixed in these proportions. About ¾ oz. bicarbonate of soda is heated strongly by a lamp for an hour, to obtain pure carbonate of soda, of which 171 grains are immediately weighed, that quantity containing 100 grains soda. This portion of carbonate of soda is dissolved in 4 or 5 ozs. hot water, contained in a basin and kept in a state of gentle ebullition, and the alkalimeter is filled up to 0 with the dilute acid. The measured acid is to be gradually poured into the soda solution, till the action of the latter on test paper ceases to be alkaline, and becomes distinctly acid, and the measures of acid necessary to produce that change accurately observed. The last portions of the acid must be carefully added by a single drop at a time. It may probably require about 90 measures. In applying the test acid, it is poured from the alkalimeter, as before, upon 100 grains of the soda salt to be tested, dissolved in two or three ounces of hot water, the liquid being stirred with a glass rod after each addition of acid. The salt contains as many grains of soda as it requires measures of acid to neutralize it, and, therefore, so much alkali per cent. The first trial, however, should only be considered an approximation, as much greater accuracy will be obtained on a repetition of it. The experiment is often made in the cold; but it is very advantageous to have the alkaline solution in a basin, in which it is heated and evaporated during the addition of the test acid. The indications then become greatly more clear and decisive, both from the expulsion of the carbonic acid and the concentration of the solution. With such precautions the proportion of soda may be determined to 0·1 grain in 100 grains salt; and an alkalimetrical determination, made in a few minutes, is not inferior in precision to an ordinary analysis.

(15) B. L. H. asks: Is the pressure in a boiler greater at the mud valve than it is at the safety valve or other part of the boiler above the water? A. The pressure is greatest at the lowest point in the boiler, and least at the highest point.

(16) W. F. McK., H. B., and many others say: We are about to build small engines to drive lathes, etc. Please give the proper dimensions for a cylinder, say, 4 inches long. We want the dimensions of all the working parts. A. Make a drawing of a large engine of good design on a reduced scale. This will give you a fair idea of the proportions.

(17) H. B. asks: What sized boiler should I use, with how many flues, to furnish steam to two cylinders 2½×11½ inches? A. Make the boiler with from 18 to 20 square feet of efficient heating surface per horse power.

(18) A. B. C. says: We are sinking a shaft in very hard rock, below the 700 feet level. The shaft at the 700 feet and about 15 feet below is running at an angle of 59°, and is 8 feet long by 4⅛ feet wide in the clear. At the 700 feet, a tunnel was run in the hanging wall or side about 12 feet, when we cut soft ground. We want to get the shaft into this soft ground in order to sink it faster. How far shall we have to sink before we strike it, as we are now running at an angle of 54°? A. About 118 feet.

(19) E. W. M. asks: If a pipe from a large tank has a check valve placed at the end, and a pipe of the same diameter has a check valve on the same level as that in the pipe from the tank, the water in the tank and pipe being of the same head, on which check valve is the pressure the greatest? A. The pressure will be the same on each, and water will flow with the same velocity from each, if the heads are equal.

Is steam used for heating buildings ordinarily hotter than that which is used for working steam engines? A. No.

How can I whiten ivory after it has turned yellow? A. Rub it with pumicestone and water, and expose it to the rays of the sun in an airtight glass case. Repeat the operation several times, if necessary.

You gave a recipe for bluing glass chimneys; will not the heat cause the color to peal off? A. No.

What causes blistering on paint, when heat is applied? A. The moisture in the paint is vaporized.

You give a recipe for plating small articles without a battery, taken from Watt's "Metallurgy." Will that plating stand for 6 months with moderate handling? A. Yes.

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(20) F. O. asks: How can I dye feathers to a red color, to be waterproof, for fishing flies? A. Take 1 oz. Brazil wood in powder, ½ oz. alum, ¼ oz. vermilion, and 1 pint of vinegar; boil them to a moderate thickness, and dip the feathers (they first having been soaked in hot water) into the mixture.

(21) C. D. asks: Can aluminum be worked? A. Yes, readily. In small quantities it costs as much as silver.

1. Will an engine of 2 inches stroke run a 6 inch turning lathe? A. Yes. 2. Should the engine be connected by a belt to the flywheel shaft of the lathe? A. You can use a belt from 1 to 2 inches wide, with a wheel on engine 8 inches in diameter, and another on lathe shaft of 6 inches.

Speaking of a 6 inch gear wheel, does it mean 6 inches in diameter over all, or from base of tooth to base of opposite tooth? A. It is the diameter of the pitch circle.

In what book can I find practical instruction for building model engines? A. We do not know of any that distinguishes a model steam engine from an ordinary one.

(22) N. J. J. asks: How many fish can be raised in a pond containing an acre of ground supplied with 100 gallons of water per minute? A. Try to raise as many as possible, and the principle of the survival of the fittest will regulate the matter.

(23) H. B. asks: 1. Will a cast iron shell turned down to the proper thickness do for a small boiler? A. It would be better, in most cases, not to turn it down at all. 2. What is used for packing the joints of a boiler three feet long? A. Rivet and caulk the joints. Ordinarily, no packing is used. 3. To what degree must iron be heated to melt common solder, and could soldering be used on boiler joints? A. To about 400° Fah. It could be used as suggested.

1. Is it possible to obtain good small sized castings of iron? A. Yes. You must have seen plenty, such as stove castings and the like. 2. Is copper cast? A. Yes. It is ordinarily sold in cast ingots.

(24) F. H. and others: It is always best to place the tightener on the slack side of the belt; and to get the greatest driving power, it should be placed close to the small pulley.

(25) J. B. P. asks: Does any harm arise from using, in the cylinder of a steam engine, a mixture of black lead, sulphur, and tallow, or black lead and tallow? A. With a surface condenser, the collection of the lubricant in the tubes sometimes causes trouble. Impure tallow frequently eats away the tallow. It is better to use good oil.

1. What is the best material for an idle pulley, used in a sawmill for transmitting motion to reverse the carriage? A. Cast iron. 2. What material is best for use in making a friction feed pulley in a sawmill? A. Cast iron. 3. Why do saws which have been worn down from 60 to 54 inches require hammering to make them run stiff enough to work? A. A saw is generally strained somewhat in the rim, and when run down it must be strained again.

I have a boiler, 14 feet long by 51 inches diameter, with 39 three inch tubes; outside diameter of tubes is 3 inches. The tubes are contained in that portion of the boiler below a line drawn 30 inches from bottom of boiler. How much water will it take to fill the boiler to a line drawn 2 inches above top row of tubes? A. You can readily calculate the volume of that part of the boiler diminished by volume of tubes.

(26) E. H. S. says: We have a schoolroom 39x23x about 14 feet. The acoustic properties of this room are very poor; at times it is hard for the teacher to make herself understood. What can we do to improve them? A. The echo has been destroyed or materially reduced in rooms of this kind by breaking up the reflex of sound, from the wall opposite the speaker, by wires. As has been explained in our previous issues, the manner of doing this, lately adopted in England, is to stretch the wires from floor to ceiling at about 6 inches apart, and, say, 6 inches out from the face of the wall. This may be tried at first for a space of about ⅓ the width of the room, at the center of the wall, and if found beneficial, afterwards extended.

(27) H. L. H. asks: How can I plate with nickel? A. Use the chloride of nickel for a solution with a nickel positive pole, and proceed in the same way as with silver plating.

(28) T. D. M. asks: Where is meerschaum found? A friend says that it is a clay in the ocean, and is washed by the waves to shore and collected in dust-like form. I think it is dug out of the earth. Which is right? A. The word meerschaum is German for froth of the sea, in allusion to its lightness and whitish color. It is a hydrated silicate of magnesia, and occurs in Asia Minor, in stratified earthy or alluvial deposits at the plains of Eskihisher, where, according to Dr. J. Lawrence Smith, it it has proceeded from the decomposition of carbonate of magnesia, which is imbedded in serpentine in the surrounding mountains. It is also found in Greece, at Hrubschitz in Moravia, in Morocco, and elsewhere.

(29) O. asks: 1. Is there any known process by which cotton seed oil can be thoroughly and economically refined? A. In the strictest sense, what is called by the trade refined oil is more or less pure oleic acid. This so-called refining of the oil is the abstraction of the dark color, accompanied by improvement in flavor, and may be accomplished by washing the oil in a solution of caustic potash or soda; but in nearly every case it will be previously necessary to submit the oil to a thorough steaming and washing with hot water, so as to remove from the oil as much as possible of the mucilaginous and albuminous matters, met with in the crude oil sometimes to a very large amount; if this precaution is neglected, there will be more waste, that is to say, a larger amount of alkali will be necessary, and in consequence thereof a larger proportion of the more solid fatty matter of the oil is abstracted. The mixed liquids—alkaline lye and oil—after having been beaten up together, separate in three distinct layers on being left to repose: the upper one is nearly colorless, so-called refined oil; the middle layer is the still yet dark colored, saponified solid fat of the oil, while at the bottom is found the dark, almost black colored alkaline lye. Owing to the great discrepancy of impurity of the crude oil (some being evidently pressed from the damaged seed) it is impossible to state exactly what yield of purified oil may be obtained. It has been found that under the most favorable circumstances 100 parts of the previously steamed oil yielded from 85 to 88 parts of refined oil. It has been found, in practice, that potash for some reason or other answers the purpose of cutting down the oil much better than soda. 2. What are the uses to which thoroughly refined cotton seed oil could be put? A. The refined oil is notoriously exported for the adulteration of olive oil.

(30) I. J. S. asks: Is there anything which will effectually destroy magnetism in steel parts of watches, except passing them through the fire? A. No.

(31) C. A. asks: How can I smooth the surface of a glass eye, it having become rough by reason of the wear of the eyelid? A. Try rubbing with a little putty powder.

(32) J. S. asks: What is a good book on astronomy, in which I could find the names and positions of the principal stars, and also the focus and power of lenses for telescopes? A. Try the "Handbook of the Stars," in the Cambridge series.

What is an argand burner? A. This is an arrangement for increasing both the supply of air and the burning surface of the flame. In the candle flame and gas jet, combustion takes place only on the outside. The argand burner has a circular wick by which a second current of air is admitted to the interior of the flame, thus burning with a double surface. The effect is increased by a glass chimney contracted so as to deflect the ascending outer current of air strongly upon the flame. Your other question should be referred to a physician.

(33) E. T. C. asks: How can I make ordinary dry Venetian red into a cake or ball suitable for use on a striking line, as a carpenter uses chalk? A. Make it into a thick paste with water, and dry.

How can I stain and polish a violin? What kind of varnish is used? A. Boil together Brazil wood and alum, and before applying it to the wood add to it a little potash. A suitable varnish for wood thus tinged may be made by dissolving amber in oil of turpentine, mixed with a small portion of linseed oil.

I have heard that split timber, such as spokes, would season much faster if set up on end to season. Is it a fact? A. Probably, from the larger surface exposed to the air.

(34) A. M. asks: How can I color gelatin? A. The gelatin is either melted or dissolved in a limited quantity of water, and the tint desired is obtained by adding one of the aniline colors. It is then poured on to a smooth warm iron plate and immediately poured off again, leaving a thin film still adhering to the plate. This is allowed to dry. It may then be cut into the required shape.

(35) S. F. B. asks: How shall I arrange to burn brimstone so as to whiten a hat by the fumes? A. Put a chafing dish with some lighted charcoal into a close room or large box, then strew one or two ounces of powdered brimstone on the hot coals, hang the articles in the room or box, make the door fast, and let them hang for some hours.

Is it not a good plan to hang the watch at night with the stem downwards, so that the bearings will wear on opposite side from where they do in the daytime while in the pocket? A. Possibly.

(36) S. S. W. asks: 1. Can neatsfoot oil be extracted from leather so as to be used again? A. Try boiling with water for a long time. The oil will be found on the surface of the water. 2. Can soap be made from the oil? A. Yes, with an alkali. 3. What is the mode of bleaching oil, and purifying it from foreign particles? A. By straining or filtering, and heating several times with equal quantities of rose water, with constant agitation.

(37) M. K. W. asks: We cannot make a portable gas machine work, as we do not know what proportions of sulphuric acid to use to a gallon of water. A. One part of acid is diluted with four or five parts of water. 2. What is carbon oil (used in the bottom as a purifier)? A. We do not know of any oil by this name. Benzine, naphtha, or gasoline will answer the purpose. See answer on p. 379, vol. 30.

(38) G. D. asks: If I place a lighted alcohol lamp under a glass receiver, it will burn a moment or two until the oxygen is exhausted; what is the difference in pressure per square inch of the air outside, and the air, *minus* oxygen, inside? A. The difference is proportional to the difference in volume; but what that difference is will depend upon the temperature, barometric pressure, etc. Alcohol is $C_4H_6O_2$, the carbon burning to form its volume of CO_2, equal to the volume of the 8 atoms of oxygen with which the carbon combines. The hydrogen in excess of $2H_2O$ forms vapor of water, which when condensed produces the diminution of volume noticed.

(39) J. S. P.—See the books on water colors and water color painting by Rowbotham, Findley, and Barnard.

(40) J. C. & Co. ask: Do you know of any method of keeping scales from the bottom of a boiler? A. We can recommend nothing better than a good feed water heater.

1. How much lower should the tail end of a 20 feet bolting reel be than the head for wheat flour? There is considerable difference of practice among millers, but one foot fall will answer very well. 2. Why do some millers steam the wheat before grinding? A. We would be glad to hear something about this from millers who practise it. Your question as to power of engine is too indefinite.

(41) J. B. asks: How do worms get into apples? A. They eat their way in.

(42) O. P. asks: 1. What power is required to raise 100 lbs. 40 feet high in 4 minutes? A. $\frac{1}{33}$ of a horse power. 2. What power is required to raise 100 lbs. 40 feet high in one minute? A. $\frac{4}{33}$ of a horse power. 3. A balance (or any heavy wheel) starts slowly. What laws govern this force? A. The same laws as govern the raising of a weight equal to the resistance of the wheel.

(43) W. H. asks: How can I melt sandarac for making the polish for black walnut wood described by you on p. 315, vol. 30? A. Gum sandarac melts readily on the application of a moderate heat.

(44) M. T. asks: How is gun cotton made? A. Pour equal parts of strong concentrated sulphuric acid, of specific gravity 1·84, and fuming nitric acid into a porcelain basin; as much cotton wool is steeped in the fluid as the acid is capable of thoroughly moistening, and the vessel covered with a glass plate, and left for a few minutes. The cotton wool is then removed from the acid, immediately transferred to a vessel containing a large quantity of water, and washed with care, the water being renewed until no more acid adheres to the gun cotton, which is next dried in a current of warm air, and finally combed to remove all lumps. The cotton should not be left too long in the acid, as it becomes entirely dissolved.

(45) M. E. P. asks: Will it add to the power of an engine to increase the length of cylinder and of course proportion all other parts to the increased length of cylinder, the number of revolutions and the pressure of steam remaining the same? A. Yes.

(46) C. E. S. asks: 1. Can a young man of 3 years' experience in the engineering and draftsman's business, not a graduate of any college, enter the navy to work under some engineer in that business? A. We think it quite likely. Address a letter of inquiry to the Chief of the Bureau of Steam Engineering, at Washington. 2. How can he become a member of the Mechanical Engineers' Association? A. We do not know of any such association in this country.

(47) S. M. W. says: I am very desirous of having an electric light for use in illuminating a magic lantern and illustrating other objects in a schoolroom. What apparatus shall I require? Will a battery or an electro-magnet be best? How long will the battery run without being renewed, and what form of battery would be best? A. You require two pencils of charcoal or baked carbon, and a battery of 50 carbon cells. The battery will cost about $150. The length of time that the battery would last and cost of running it would depend upon its use. If you used it every evening for several hours, the battery would require to be renewed every day, at an expense of about $3.

(48) O. H. asks: 1. The weight of a pile driver is 100 lbs., falling 20 feet; what is the force of the blow? A. We do not know of any rules by which it could be calculated. 2. Would a weight of 500 lbs. increase the force to five times? A. Yes.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

A. B. C.—Quartz rock.—R. M. K.—It is black oxine of iron.—W. F. B.—It is iron pyrites.—J. B. T.—It is called iron pyrites, and is composed of iron 46·7 per cent, and sulphur 53·5 per cent.—R. W. T.—No. 1 is datholite or borate of lime with native copper. No. 2, 3, and 7 are calamine or silicate of zinc. No. 4 is micaceous schist. No. 5 is siderite or carbonate of iron with red oxide of iron. No. 6 is conglomerate rock.—D. W. D.—No. 1 is clay mixed with scales of mica and impregnated with oxide of iron. No 2 is sulphide of lead or lead ore. No. 3 is striped jasper. No. 4 is black marble.—A. H. C.—It is not, as you suggest, either tourmaline, sphene, or zircon. It is pyroxene.—J. K.—The sample contained very few entire specimens of *pinnularia*, and it was much more difficult to obtain perfect specimens of *navicula*, which were also present. The amount of fine sand and grit present requires that the earth be treated with extreme delicacy and caution, for which reason we consider the deposit of little value.—A. W. H.—Chemical analysis of your specimen of soil shows the presence of common salt or chloride of sodium and traces of other chlorides. Along with these are the sulphates of soda and lime, also a small amount of alumina and oxide of iron. Particles of quartz, both white and colored, are mixed up with the powder, and shreds formerly belonging to plants and probably marine animals also.—The large beetle received some time ago without name or address is the *scarabæus tityris*, and the curious spider belongs to the genus *galeodes*.

H. P. asks: How can I imitate twist on the barrel of a gun?—G. F. C. asks: Can rosin be removed from varnish after it has settled and hardened upon it without injuring the varnish, for instance, from a violin that is varnished?—W. S. B. asks: 1. Has it ever been discovered whether there is an open polar sea at the south pole? 2. Did Captain Ross ever make any northern explorations?—L. McB. asks: What kind of varnish is the best for a violin? Should the violin be oiled before applying the varnish?—J. H. F. asks: Who was the discoverer of the method of manufacturing tinfoil used in America?—J. D. H. asks: 1. What can I put in aniline dye for coloring wood, so as to enable it to take a bright polish after being dried? 2. How can I stripe wooden balls in different colors, so that the colors will not run together, and will dry quickly?—H. P. L. asks: How can I make paper pulp from old scraps of paper?—F. W. D. asks: How are violins stained?—W. H. A. asks: 1. I want to make some piano wires. How is it done, and how are they tempered? 2. How can I plate steel wire?—F. N. D. asks: What is the rule by which paper can be cut so as to cover a globe?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Shoddy. By J. L. N.
On Blast Furnaces. By E. J. H.
On Drawing in Education. By G. R. D.
On a Magneto-Electric Machine. By E. G. W.
On Cable Telegraphy. By G. L.
On Double Entry Bookkeeping. By S. G.
On a Wonderful Mechanism. By G. B. K.
On a Flying Machine. By T. H. C.
On Cast Iron in Boilers. By J. W. H.
On Curious Apples. By E. L. E., and by C. L. S.
On Zinc in Boilers. By J. W. C., and by L. T. W.
On Machine Belts. By J. R. P.
On Removing Snow. By ——.
On Boiler Explosions. By R. D. W.
On Modern Spiritualism. By S.

Also enquiries and answers from the following:

W. W.—M. C. G.—J. B.—J. K.—E. L. E.—A. H. M—S. L. G.—P. H. B.—V. W.—F. B. M.—F. W. P.—J. M.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who sells books on watch and clock making? Whose is the best work on oil painting as a fine art? Who sells double-barreled breech-loading hunting rifles? Where can chrome steel be obtained? Who makes the best lime kiln? Why do not manufacturers of explosives advertise in the SCIENTIFIC AMERICAN? Whose is the best rock drill?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

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December 1, 1874,

AND EACH BEARING THAT DATE.

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EXTENSION GRANTED.

30,802.—CLOTHES WRINGER.—G. J. Colby.

DISCLAIMER FILED.

30,802.—CLOTHES WRINGER.—G. J. Colby.

DESIGNS PATENTED.

7,905.—MULEY SAW FRAME.—T. E. Chandler, Indianapolis, Ind.
7,906.—PIPE STEM.—W. Demuth, New York city.
7,907.—PIPE STEM.—W. Harvey, New York city.
7,908.—STAIR RODS.—M. Krickl, New York city.
7,909.—FORK HANDLES.—C. Osborne, North Attleborough, Mass.
7,910.—TYPE.—A. Little, New York city.
7,911 & 7,912.—SODA WATER APPARATUS.—G. F. Meacham, Newton, Mass.
7,913.—SODA WATER APPARATUS.—F. H. Shepherd *et al.*

TRADE MARKS REGISTERED.

2,099.—WORM MEDICINES.—A. W. Allen, New York city.
2,100.—FLOUR.—F. Bertschy, Milwaukee, Wis.
2,101.—SHEET IRON.—Brittan & Co., San Francisco, Cal.
2,102.—CLOCKS.—H. J. Davies, New York city.
2,103.—DRESS GOODS, ETC.—Everett Mills, Lawrence, Ms.
2,104.—BLUING.—G. A. Moss, New York city.
105.—CIGARS.—Sartorius & Reinig, Memphis, Tenn.

SCHEDULE OF PATENT FEES.

On each Caveat..... $10
On each Trade mark..... $25
On filing each application for a Patent (17 years)..... $15
On issuing each original Patent..... $20
On appeal to Examiners-in-Chief..... $10
On appeal to Commissioner of Patents..... $20
On application for Reissue..... $30
On filing a Disclaimer..... $10
On an application for Design (3½ years)..... $10
On application for Design (7 years)..... $15
On application for Design (14 years)..... $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, NOVEMBER 25 to DECEMBER 3, 1874.

4,087.—S. J. Wright, Madrid, St. Lawrence county, N.Y., U. S. A combined carriage wrench and bit brace, called "Wright's Combined Carriage Wrench and Bit Brace." Nov. 25, 1874.

4,088.—W. S. Taylor, Toronto, Ont. Improved ticket system, called "Eureka Street Car Ticket System." Nov. 25, 1874.

4,089.—E. A. Yerkes, Philadelphia, Pa., U. S. Improvement on the manufacture of shovels and spades, called "Yerkes' Improvement in the Manufacture of Shovels and Spades." Nov. 25, 1874.

4,090.—D. Renshaw, Boston, Mass., U. S. Improvements on sectional steam generators, called "The Renshaw Boiler." Nov. 25, 1874.

4,091.—T. R. Crampton, No. 11 Victoria street, Westminster, England. Improvement in the manufacture of iron and steel, and on the construction and lining of revolving furnaces, and on apparatus connected therewith, called "Crampton's Improvements on the Manufacture of Iron and Steel, and in the Construction and Lining of Revolving Furnaces, and on Apparatus connected therewith." Nov. 26, 1874.

4,092.—J. F. Cass, L'Original, Prescott county, Ont. Improvements on folding stands, called "The Improved Folding Stand." Nov. 26, 1874.

4,093.—C. M. Nes, York, York county, Pa., U. S. Improvement on the manufacture of steel, called "Silicon Steel." Nov. 26, 1874.

4,094.—S. Keyes, Bennington, Bennington county, Vt., U. S. Improvement on steam boiler furnaces, called "Keyes' Improved Steam Boiler Furnace." Nov. 26, 1874.

4,095.—E. M. Slayton, Port Byron, Cayuga county, N. Y., Improvement on seamless paper vessels, and the machinery for manufacturing the same, called "The Slayton Seamless Paper Vessel." Nov. 26, 1874.

4,096.—M. E. Zeller, Ivesdale, Champaign, Ill., U. S. Improvements on harness findings, called "Zeller's Harness Finding." Nov. 26, 1874.

4,097.—W. J. Kent, Buffalo, Erie county, N. Y., U. S. Improvements on reed organs, called "Kent's Improved Reed Organs." Nov. 26, 1874.

4,098.—C. A. Blomquist, La Porte, La Porte county, Ind., U. S. Improvements in railway rail joints, called "Blomquist's Improved T Rail Joint." Nov. 26, 1874.

4,099.—W. F. Patterson, Boston, Mass., U. S. Improvements on screw drivers, called "Patterson's Reversible Screw Driver." Nov. 26, 1874.

4,100.—R. Freeland, Montreal, P. Q. Improvements on the manufacture of soap, called "Freeland's Automaton Soap Maker." Nov. 26, 1874.

4,101.—G. W. Brown, Buffalo, N. Y., U. S. Improvements on spring beds, called "Brown's Improvement in Spring Bed Bottoms." Nov. 26, 1874.

4,102.—S. W. Reese and J. F. Wright, Chicago, Ill., U.S. Improvement on stencil plates, called "Reese's Adjustable Stencil Letters." Nov. 26, 1874.

4,103.—G. Curtis, Ogdensburgh, St. Lawrence county, N. Y., U. S. Improvements on water wheels, called "Curtis' Turbine Water Wheel." Nov. 26, 1874.

4,104.—R. J. Took, Montreal, P. Q. Improvements on shirts, called "Took's Shirt." Nov. 26, 1874.

4,105.—R. Ross, Vergennes, Addison county, Vt., U. S. Improvements on machines for finishing horse shoe nails, called "Ross' Machine for Finishing Horse Shoe Nails." Nov. 26, 1874.

4,106.—J. Leith, Ridgway, Elk county, Pa., U. S. Improvements in car couplings, called "Leith's Automatic Car Couplings." Nov. 26, 1874.

4,107.—B. A. Whitaker, Wellington Square, Wentworth county, Ont. Improvements in rollers for curtains, called "The Acme Curtain Roller." Nov. 27, 1874.

4,108.—W. T. Root and W. G. Wood, Ingersoll, Oxford county, Ont. Improvement on boilers, called "Root & Wood's Improved Boiler for Steam Power and Heating Buildings." Nov. 27, 1874.

4,109.—W. H. Fulton, Foxcroft, Piscataquis county, Me., U. S. Improvements on machine for raising or extracting stumps, rocks, etc., called "The Iron Giant." Nov. 27, 1874.

4,110.—F. A. Lockwood, Fall River, Bristol county, Mass., U. S. Improvements on machine for scouring, glossing or setting leather or beaming hides, called "Lockwood's Hide and Leather Working Machine." Nov. 27, 1874.

4,111.—F. W. Ofeldt, Newark, Essex county, N. J., U.S. Improvements on gas machines for the vaporization of gasoline or other volatile hydrocarbons, called "Star Gas Machine." Nov. 30, 1874.

4,112.—J. B. Camyré, Montreal, P. Q. Improvement in boilers for washing clothes, called "The Nonpareil Steam Washing Machine." Dec. 1, 1874.

4,113.—T. Wallace, Chicago, Cook county, Ill., U. S. Improvement in emery stone pearling machines, called "Wallace's Emery Stone Pearling Machine." Dec. 1, 1874.

4,114.—C. Mee & J. George, Kingston, Ont. Improvement on melodeons and organs, called "Mee's Improvement on Organs and Melodeons." Dec. 1, 1874.

4,115.—Wm. Inglis, Bolton, Lancaster county, Eng., and J. Inglis, Montreal, P. Q. Improvement on elevator vessels, called "Improved Grain Elevator Boats." Dec. 1, 1874.

4,116.—N. Nilson, Minneapolis, Hennepin county, Minn., U. S. Improvement on steam brakes for railway cars, called "Nilson's Steam Brake for Railway Cars." Dec. 1, 1874.

4,117.—G. Ott, Warwick township, Lambton county, Ont. Extension of No. 217, called "Ott's Beehive." Dec. 1, 1874.

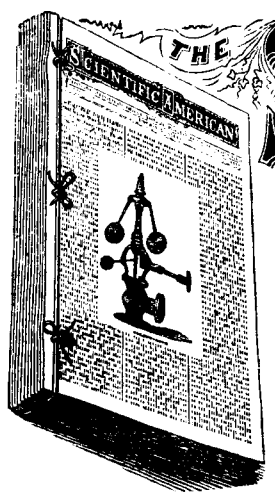
4,118.—C. P. Holmes, New York city, U. S.—1st Extension of 1,704, called "The United Canada Churn." Dec. 2, 1874.

4,119.—C. P. Holmes, New York city, U. S.—Second Extension of 1,704, called "The United Canada Churn." Dec. 3, 1874.

4,120.—R. Dudley, Erie, Erie county, Pa., U. S. Improvements on torsion springs for cars, wagons, etc., called "Dudley's Improved Torsion Spring." Dec. 3, 1874.

4,121.—E. Chesterman, Philadelphia, Pa., U. S. Improvements on apparatus for registering and classifying the fares of passengers, called "Passenger Fare Enumerater and Classifier." Dec. 3, 1874.

PUBLISHED WEEKLY.



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TERMS.

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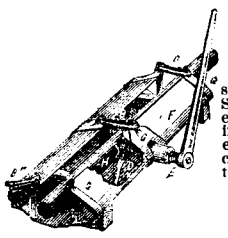

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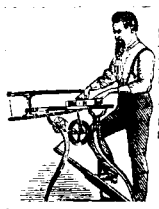

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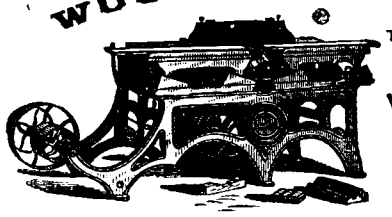

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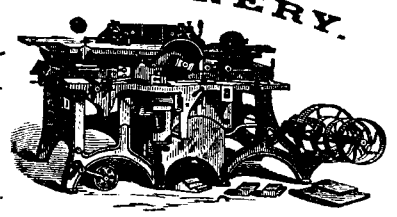

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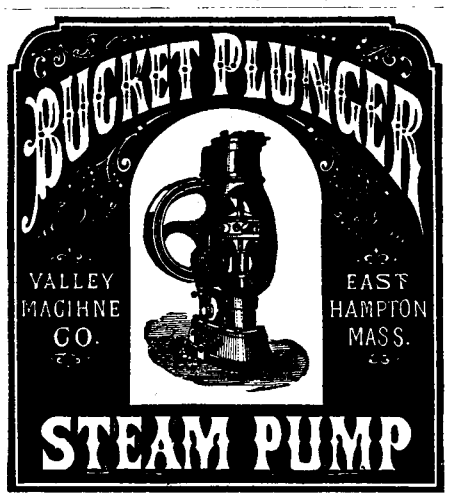

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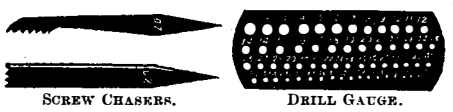

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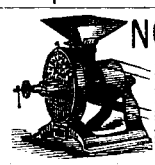

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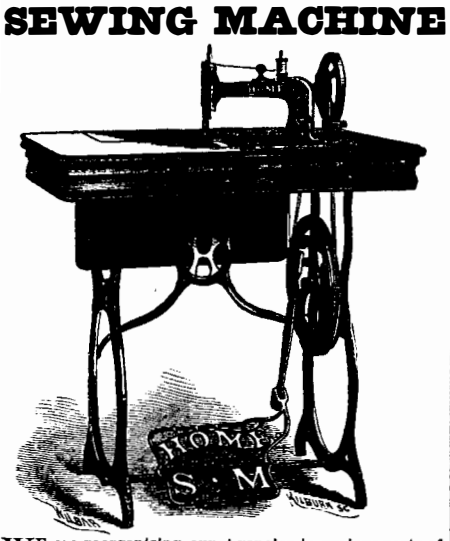

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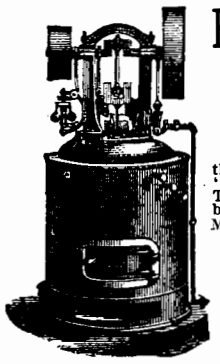

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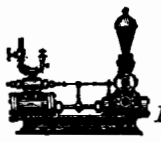

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